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Kentucky Geological Survey.

Bulletin No. 13

Serial No. 15

THE UPPER CUMBERLAND COAL FIELD

The Region Drained by Poor and Clover Forks

IN

HARLAN AND LETCHER COUNTIES

1912

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MIDDLE RIDGE.

NEAR MOUTH OF RAZOR FORK, LOOKING UP CLOVER. SHULER BOTTOM.

Kentucky Geological Survey

CHARLES J. NORWOOD, Director.

BULLETIN No. 13

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REPORT ON

The Upper Cumberland Coal Field.

The Region Drained by Poor and Clover Forks

IN

HARLAN AND LETCHER COUNTIES.

By JAMES M. HODGE.

Printed by the Interstate Publishing Co.

1912.

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HALF-TONES.

- I. Near mouth of Razor Fork, looking up Clover. Shuler Bottom.....Frontispiece.
Was taken in December from a point on Big Black, near the mouth of Razor Fork, looking up the Right Fork of the Clover Fork. Shows the Shuler bottom in the foreground, with Middle Ridge on the left and Little Black on the right. This is the last of the bottom land going up Clover Fork.
 - II. Morris Farm, head of Razor Fork.....Follows page 22
Is a view on top of Big Black Mountain, at the Creech fields, looking southeast. The Big Black is also seen in the distance. Taken in December.
 - III. Looking up Nim Hollow (on Razor Fork) from Middle Ridge.....Follows page 128
Was taken in December from a point on Middle Ridge 950 feet above the forks of Clover Fork. Big or Clearing Cove Ridge of Big Black is seen on the left, Yellow Buck Spur in the center, and Hall's Spur on the right.
 - IV. Head of Camp Fork of Big Looney.....Follows page 196
Was taken in December from the north side of the point of Little Fork Ridge, about 3,400 feet above tide, looking north of east across Big Looney creek towards Big Black. Shows the point of Fickle's Ridge in the center, with Fickle's Cove to the left of it, the headwaters of Camp Fork to the right of it, and Gilliam's Ridge on the extreme right towards the lower corner.
 - V. Head of Big Looney Creek.....Follows page 198
Was taken in December from a point on the north side of the point of Little Fork Ridge, about 3,500 feet above tide, looking south. Shows the southern face of Big Black Mountain, with Gilliam Ridge on the left and Rockhouse Ridge in the center, with Rockhouse Fork between. Stillhouse butt is on the right.
-

Memoranda Concerning Illustrations.

In Figure 2, page 3, the name "Harlan coal" is placed opposite the wrong bed. It should be opposite the bed next below.

In Figure 4 "Fossil sandstone," shown above the Limestone Coal in Black Mountain, should be Fossil limestone.

The "Lines G-G" "H-H" and "I-I" referred to in the profile sections, Figures 3, 4, and 5, are lines indicated on the map that accompanies this report.

PREFATORY.

His Excellency, JAMES B. McCREARY,

Governor of Kentucky.

Sir: This report is one of those the printing of which has been delayed through delays of printing contractors, as was set forth in my Biennial Report of Progress for 1910 and 1911. The larger part of the field work needed to round out his notes of observations that had extended through about eighteen years was performed during the administration of Governor J. C. W. Beckham, and the report was so well advanced toward completion that an order for its publication was made in November, 1907. Delays in printing other reports that had been placed in the then contractor's hands, however, delayed this one, and Mr. Hodge, taking advantage of such delays brought his work up to later date—the last of the report being completed in 1910, during the administration of Governor Augustus E. Willson. Other reports were in the printer's hands still ahead of it but, with Bulletin 14 (Coals of the Region Adjacent to Pineville Gap), which has come from the press ahead of it, it was placed in the present contractor's hands July 31, 1911. Though the report has been slow in reaching the public, it is believed that its value will be thoroughly well appreciated by all who have occasion to investigate the field that it covers.

Though needing some railroad extensions up the Poor Fork and the location of three or four mining plants now in operation in Harlan and the upper part of Bell—all of which may be put on by hand—the accompanying map will be found to still serve its purpose very well.

Very respectfully,

CHARLES J. NORWOOD,

June, 1912.

Director.

**REPORT ON THE REGION DRAINED BY POOR
AND CLOVER FORKS OF CUMBERLAND
RIVER IN HARLAN AND LETCHER
COUNTIES.**

The region drained by Poor and Clover forks includes the southern slope of Pine mountain from the junction of those streams to Procter gap at the head of Poorfork; the whole of Big Black mountain from Harlan town to its uniting with Little Black mountain, and thence, eastward, its northern slope to Procter gap; and the northern slope of Little Black mountain from Harlan town eastward. The Kentucky-Virginia State line bounds the region on the south and east (from ten miles east of Harlan town) along the crests of Little and Big Black mountains and, via Procter gap, across to the top of Pine mountain.

The greatest width of the region is about nine miles, its extreme length thirty-eight miles and its total area some two hundred and fifty square miles, of which about two hundred are in Harlan county and fifty, at the eastern end, in Letcher county.

Big Black mountain, lying along the center of the region in its western half and more, presents the most prominent feature of its topography, rising to a height of 4,200 feet above tide and 3,000 feet, at the head of Clover fork, above Harlan town. It is, in that vicinity, the highest point in the State, and it maintains throughout its entire length a greater altitude than either Pine or Little Black mountains, north and south of it.

Poor and Clover forks present an almost unbroken succession of narrow bottom lands in cultivation, but besides them only the larger branch streams afford opportunity for economical location of coke ovens. On Plate I. is pictured the last of the bottom land going up Clover

fork. The view was taken at the mouth of Razor fork, looking up Clover. All streams head against mountains excepting Poor fork at Procter gap.

This gap and the Cumberland River valley afford the only means of entrance by rail to the region, except by tunneling, and, though it is hardly probable that Pine mountain will be penetrated in this way at any point along Poor fork, the tunneling of Little Black mountain to Clover fork is probable, and of Big Black to Poor fork possible.

As yet there are but two wagon roads from Poor fork across Pine mountain; across Big Black, one to Stonega, Va.; none to Clover fork; and two from Clover fork across Little Black mountain. Bridle paths are infrequent and often almost impassable.

The whole region is contained within the geological trough formed by uplifting of Pine and Stone mountains, and the resultant synclinal axis, cutting across Big Black mountain, is shown, approximately, on the accompanying map of the upper Cumberland Valley and adjoining regions.

There are exposed in the region some four thousand feet of coal measures, beginning near the base of the Lower Conglomerate formation and extending up through not less than twenty four hundred feet of the carboniferous. Those measures, excepting the Conglomerate of Pine mountain, are all exposed in Big Black mountain.

Figure 1 shows the lower strata as found near Harlan, the sandstones and Harlan coal being given as named by the United States Geological Survey (Prof. Paper No. 49).

Figure 2 gives the section at the highest point of Big Black mountain, at the butt of Hall's spur, where the highest measures of the region are found. That part of the section below the Harlan coal is but roughly approximate, data for it having been obtained near Keokee, Virginia, where strata are in part somewhat tilted. The remainder of the section is substantially correct. Tide-water elevations are given in it, as determined for that particular point of Black mountain.

Only the principal coal beds, most useful for correlation are there portrayed, but besides those twelve there

Fig. 1.

COMPILED SECTION
CLOVER FORK
NEAR HARLAN

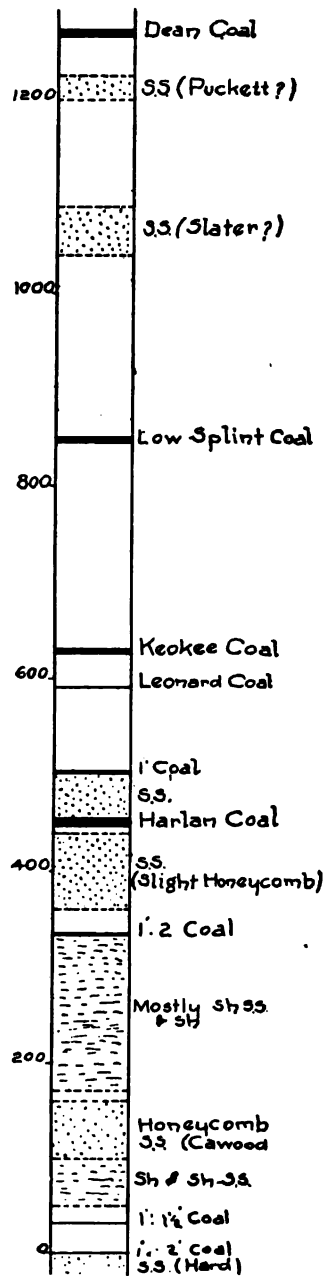
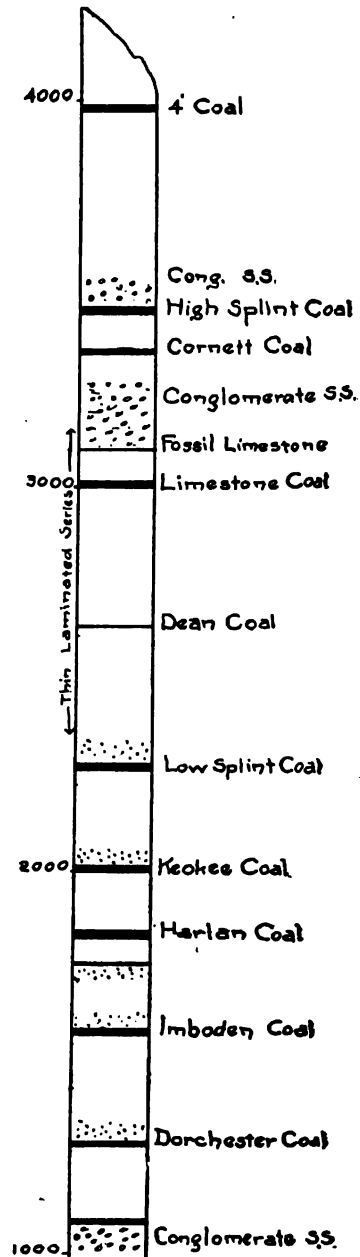


Fig 2

COMPILED SECTION
NEAR HEAD OF
CLOVER FORK



are nearly as many more having a thickness of coal of three feet and upward, and unnumbered smaller ones. It is little likely that any but the twelve will be worked to much extent, as conditions of area, accessibility and contiguity to other beds, one or all, are usually unfavorable. But they are all included in the detailed description which forms the bulk of this report.

Of the twelve beds shown in the section all cannot be classed as workable in this region, because the lower coals are found thin there, though probably worked in thick coal a few miles south in Virginia; and the coal shown above the High Splint bed is too high to exploit for its small area.

In the vicinity of Harlan town the dip is northward, away from the axis, a secondary basin having been formed, with its lowest point apparently near the mouth of Poor fork. This reverse dip seems to run out eastward, near Ages creek.

From Jones' to Yokum creek the axis is found to drop at a rate of about two and one-half per cent.; but thence eastward it rises to Fugitt creek at an average rate of but ten feet per mile. From Fugitt to Big Looney creek its average rise is fifty feet per mile; and thence to Oven fork nearly level. On either side of the axis the dip varies greatly in amount, and the line of greatest dip varies much in direction, but it is almost uniformly towards the axis. The cross-sections of figures 3, 4, and 5 show the dip, with a fair approach to accuracy, as it has been deduced on the lines selected.

The quality of the coals of the region is, in general, excellent, though they exhibit wide variations not only in the different beds but also in individual beds, in both physical properties and composition.

There is in them a larger proportion of splint coal than is known elsewhere, and a less proportion of cannel coal than on Kentucky river waters. Though five or six beds contain cannel, the Keokee bed in considerable thickness, there appears to be nowhere in the region any considerable area of it.

The coals are so generally capable of coking that it may be expected of them all, until proven otherwise, that they will make good coke. Even the hard splint coals appear to serve nearly, if not quite, as well as the softer coals, though perhaps too dry, or low in volatile matter, for economical use in that way.

Mining of splint coal appears likely to become a specialty in the region because of its thickness, fine quality and durability under exposure to weather; the dump, in one noted instance, containing lumps of coal unaltered after many years of weathering. (See page 23.)

GENERAL DESCRIPTION OF COAL BEDS.

The lowest coals of the series are found in this region only in Pine mountain, where they rise northward at such a rate that though they may crop out low down in deep ravines near its base, they reach the surface near to, and do not pass beyond, its crest. They are enclosed between heavy layers of hard pebble conglomerate and are accompanied by little shale.

But little is known of them here and what is known does not encourage farther investigation. The only known openings are above Oven fork, one on Bad creek and one a half mile below Procter gap, both with less than three feet of coal.

But only a few miles down Cumberland river from the mouth of Poor fork a handsome splint coal of about $3\frac{1}{2}$ feet thickness has been opened among the Pine mountain cliffs, and in view of the fact that these interconglomerate beds have generally provided a workable coal where lying nearly level along the margin of the field, in Kentucky and as at Pocahontas, W. Virginia and elsewhere, it is not unlikely that better deposits than those above mentioned may be yet found in Pine mountain along Poor fork.

If such be the case they can hardly be classed, at the present time, as workable, on account of their steep pitch, but they should serve to encourage exploration by drilling along Poor fork where the dip of the the beds is slight and their depth not excessive.

No attempt was made to determine this depth, but it is judged that at the mouth of Straight branch, 12 miles up Poor fork, the lowest of the beds, of which there are, perhaps, three, is considerably less than 500 feet under Poor fork. (There are 800 to 900 feet of strata cropping between Poor fork here and the Harlan coal.)

At the mouth of Straight branch, ten feet above it, is opened the lowest coal of Black mountain, over 800 feet below the Harlan bed, as shown in the section, figure 164. It has 4 feet of coal here, and if such thickness is continu-

ous an extremely valuable bed, practically unknown, underlying the whole of the region south of Poor fork, awaits development.

Its outcrop above and below Straight branch soon crosses to the north of Poor fork where its identification must be difficult, and its thickness liable to be distorted by the uplift of Pine mountain; so that little further satisfactory information regarding it can be had except by mining and by drilling.

Following is an analysis of this coal from a sample obtained at the mouth of Straight branch:

Lab. No.	Moisture	Vol. C. M.	Fixed C.	Ash	Sulphur	Phos.
2696	5.92	32.95	56.66	4.47	0.68	0.064

Specific Gravity.... $\left\{ \begin{array}{l} 1.351 \\ 1.378 \end{array} \right\}$ B. T. U.....12,490 Total C.....69.29

There appears to be no coal of consequence on Straight branch between the coal at its mouth and the Harlan bed, nor elsewhere within the region has a coal of so much as 3 feet thickness been found, known to be below the Harlan bed, excepting one of just 3 feet of clean coal as opened on Island branch, $14\frac{1}{4}$ miles up Poor fork, and on the next branch above (probably of the same bed) with a foot more of coal $1\frac{1}{2}$ feet above the main seam. The latter opening appears to be 100 feet below one into the Harlan bed, but as its coal has a southeast dip of nearly 18° the stratigraphic interval is, doubtless, much more than 100 feet, but data for its determination are wanting.

But, leaving Big Black mountain and passing into the Big Stone Gap region of Virginia, a widely differing section under the Harlan coal is found to obtain, the lower part of figure 2 representing the principal coals under the Harlan bed found near Keokee. It is presumable that, though they may none of them go through to the Poor fork, one or more of them will extend in workable thickness across the line, into Kentucky and a short description of them and associate beds is therefore given.

Some Virginia Coals.

The bottom one of these beds consists of a bright splint coal, in this vicinity, about 4 feet thick, lying about ten feet above loose conglomerate pebbles evidently *in situ*. The bed appears to be represented westward by a 5-foot opening on the Lower Crab Orchard, and eastward by the 3 to 5-foot coal worked at West Norton. At the latter point there is evidence of an easily disintegrated pebble conglomerate, probably about one foot thick, some 30 feet below the coal.

The Dorchester bed shown in the section, figure 2, is representative of a group of beds, of which two only have been discovered near Keokee, one of them 3 to 5 feet thick. At Dorchester there are in the group, three beds 40 to 80 feet apart with about 4, 5 and 8 feet of coal, respectively, though the latter soon splits into two distinct beds. Of this group the lower and upper beds are mined at Dorchester, and one seam of the upper bed at Sutherland.

The high reputation of the Dorchester coke, one of the first in this field to enter the market, increases the desirability of finding the beds in workable thickness in Kentucky, but the diminution of the group at Keokee and its insignificance on Straight branch, on the north side of Big Black mountain, militate against finding it of much value north of the Virginia State line.

The Imboden bed is at present the principal coking coal bed of the Big Stone Gap region, being mined most extensively on Pigeon, Looney and Callahan creeks, and also at Roaring Fork and near the top of the hill at Dorchester and Sutherland. The average thickness of good coal in these mines is probably somewhat over six feet and its coke ranks with the best.

Like the Dorchester the coal diminishes to the southwest and northwest, but its workable area is more likely to extend into Kentucky than is the former, as the larger body of thick coal developed lies nearer the State line.

It is possible, too, that the thick coal opened near the

head of Poor fork, detailed near the end of this report, is of this bed.

The Kelly bed, not shown in figure 2, lies 30 to 60 feet above the Imboden. Though rising to a maximum height, so far as known of about 8 feet of nearly solid coal, at Kelly View, it appears to be worthless though quite persistent west of Wise county. Its undermining, in the Imboden bed, promises its almost total loss.

None of the foregoing beds have been identified with certainty on Clover or Poor fork, but beds higher in the series have been correlated beyond question with those mined in Virginia and further description will include them as found in both States.

The Harlan Bed. This name to the bed was given by the U. S. Geological Survey and is adopted in this report. About Harlan it is called the Town Seam and also the four-foot and six-foot seam according to its thickness at various openings. In the Pocket region of Virginia it is known as the No. 3 bed, and on Upper Clover fork and in the Crab Orchard of Virginia as the Wilson bed.

Little Black Mountain from its end at Harlan town to, perhaps, where the State line reaches its summit contains, probably, the finest field of this bed. At Harlan, where it is somewhat high in the mountain, the coal is 6 feet thick, and in numerous openings on the south side of Clover fork to Jones' creek its thickness nowhere falls below 5 feet, except at one opening $3\frac{1}{2}$ feet, while its partings are not excessive. On that creek it varies from $3\frac{1}{2}$ to 5 feet. Across the mountain, on Crummies creek, it has nearly 8 feet of coal almost without parting.

On both sides of Big Black mountain near Harlan frequent small mines show a nearly uniform 4 feet of solid coal.

On Yokum creek its partings are ruinous in its one opening there, but it soon goes below drainage, reappearing at St. Charles, Va., with $3\frac{1}{2}$ feet of clean coal.

On Bailey creek the bed has $3\frac{1}{2}$ to $5\frac{1}{2}$ feet of coal with partings variable, but nowhere prohibitive of mining; and, with a maximum of 4 feet, this appears to be its condition on the north side of Clover fork up to Seagrave creek.

On the south side of Clover above Yokum creek the partings have nearly disappeared, with $4\frac{1}{2}$ feet of coal in the bed, while on the next branch above they are again excessive.

On Seagrave creek there are $3\frac{1}{2}$ feet of coal in the bed and a parting of six inches. A half mile above Seagrave, on both sides of the creek, just before going below drainage the bed shows 5 feet of coal, the lower bench, of $3\frac{1}{2}$ feet, alone being workable.

At the southern base of Little Black mountain east of The Pocket as far as Looney creek are many openings indicative of the condition of the coal, below drainage, toward the head of Clover fork. These show great variation in number and thickness of partings and in thickness of coal, the latter ranging from 3 feet, workable, up to 8 feet.

On the South side of Poor fork, for the first 8 miles up the bed is nearly uniform at 4 feet of clean coal, though appearing also with $4\frac{1}{2}$ and with nearly 6 feet of coal and 6 inches parting.

From Straight branch up to Big Looney creek the bed is much split up, but carries generally from 3 to 5 feet of workable coal. Partings become more numerous eastward until, on Clover Lick and Big Looney creeks, they number six and eight, respectively, aggregating $1\frac{1}{2}$ and $3\frac{1}{2}$ feet, while the coal in each amounts to 9 feet.

Eastward from Big Looney creek the partings diminish in size and number till on Colliers creek the bed is almost compact in one 5-foot seam of coal. The same condition occurs also on Sugar Camp branch, $\frac{3}{4}$ mile farther up Poor fork.

On Roberts branch the coal is again nearly 9 feet thick, and here with but small partings.

At Partridge P. O. the coal crops in the bottom land, but it rises again to openings farther up the fork giving 5 and 6 feet of coal, with small partings, except that on Franks creek one parting is 16 inches thick.

An adjacent opening on Smith creek is the last on Poor fork known to have been made into the Harlan bed, and there is some question whether this and the one on

Franks creek may not be of the Imboden bed, but correlation with the Harlan is very nearly proven, as may be seen by referring to page 216.

In physical properties this coal is probably more uniform than are most of the principal others of this region. It carries but a small proportion of splint, and over much of its area none at all. It is essentially a coking coal, and its coke, introduced into the market from Keokee, is proven physically of the best.

The representative analyses of its coal and coke, given below, show that in chemical constitution the fuel is of a high grade, though in some instances too high in sulphur and ash. The excessive sulphur appears mostly in the coal along the southern base of Little Black mountain in Virginia. The Kentucky coal should be available for coke for any service.

Underlying, as the bed does, nearly all of the area under discussion, exclusive of Pine mountain, and with the probability, with all its irregularity, of comparatively little of its area unworkable, it should finally prove the most valuable bed of the region, though others may take precedence at first.

HARLAN COAL ANALYSES.

Location	Moisture	V. C. M.	Fixed C.	Ash	Sulphur	Phos.
Opposite Harlan.	1.68	35.72	60.20	2.40	.574	.....
Baker Entry....	1.76	34.64	60.50	3.10	.904	.....
Kitts Branch....	1.70	35.70	59.60	3.00	.750	.....
Ages Cr.....	1.544	36.869	53.572	6.740	1.275	.....
Bailey Cr.....	.....	38.50	54.90	6.60	1.073	.030
Laurel Br.....	.....	39.10	55.30	5.60	.949	.011
Lige Br.....	.....	38.50	54.80	6.70	1.07	.009
Gilberts.....	1.920	37.505	53.377	6.195	1.003	.....
Perkins Br.....	1.60	35.00	57.40	6.00	.558	.....
Clover Lick Br..	.....	38.40	57.60	4.00	1.21	.011
Big Looney Cr..	.....	35.57	61.26	3.17	1.06	.005
Roberts Br.....	1.40	33.40	59.08	6.12	1.426	.....

HARLAN COKE ANALYSES.

Location.	Moisture	V. C. M.	Fixed C.	Ash	Sulphur	Phos.
Bailey Cr.....		2.80	88.80	8.40	.619	.024
Laurel Br.....		3.80	86.90	9.30	.715	.008
Lige Br.....		3.90	86.20	9.90	.70	.008
Clover Lick Cr..		2.10	89.50	8.40	1.11	.015
Big Looney Cr..		3.15	92.60	4.25	1.10	.012
Roberts Br.....	0.70	.....	89.30	10.00	.863	.....

The Leonard Bed. This bed is so named because of its development about Leonard Postoffice, at the mouth of Child's creek, Clover fork. Lying 120 to 160 feet above the Harlan and 5 to 60 feet below the Keokee bed, it is a comparatively unimportant one, though occasionally showing well. It may easily be mistaken for the Keokee, or vice versa, and it is quite possible that in the following pages such error may have occurred, though much care has been taken in their discrimination.

In going up Clover fork the bed is first recognized on Yokum creek, Pounding Mill branch, 3 feet, or a little more, without parting.

Its next appearance as a workable coal, if its quality is satisfactory, is at about a mile above Seagrave creek, where 4 feet of cannel coal, as reported, is separated by a parting of 14 inches; and across on the south of Clover fork is a maximum of 20 inches cannel on $3\frac{1}{2}$ feet of soft coal.

Openings one-half to three miles farther up Clover give about 5 feet of soft coal with three partings additional, and beyond these, nearly to Child's creek, the partings become excessive.

On Child's creek near its mouth the lower 3 feet of the bed becomes workable, but becomes thin again before running below drainage two miles above Child's creek. It rises again above drainage $4\frac{1}{2}$ miles above Child's creek, and remains accessible up to Razor fork, but shows only as a thin coal, or else badly ribbed with shale.

On Poor fork the bed first shows an approach to workable condition on Straight branch. Beyond this, to Clover Lick creek, is a bed showing at intervals some 4 feet of coal and two partings, which may be either the Leonard or the Keokee. The Branson entry on Clover Lick, 5 feet of clean coal appears to be a continuation of the Leonard bed. Elsewhere on Clover Lick the bed has 3 to 4 feet of coal without parting.

On Big Looney creek the bed runs $3\frac{1}{2}$ to 4 feet of coal without parting. On Little Looney and Preacher Creeks in Virginia it has about $3\frac{1}{2}$ feet of coal.

Above Big Looney creek the coal is mixed with shale and bone on Wolf Pen branch, but on Coldiron branch,

5½ miles above Big Looney there is 3 feet solid of good coal, and probably 3½ feet on Lewis creek.

On Colliers creek and above to Oven fork it varies from 2 to 3½ feet, but the thicker coal has two partings, and cannot be classed as workable. Nor is there indication of its becoming so above Oven fork, though the bed has not been identified there.

Following are analyses of this coal and of its coke:

LEONARD COAL ANALYSES.

Location.	Moisture	V. C. M.	Fixed C	Ash	Sulphur
Seagrave Cr.....	1.58	31.82	63.20	3.40	1.288
Steep Hollow.....	3.60	29.40	57.00	10.00	6.22
Below Heads Cr.....	1.880	33.208	63.098	2.350	.563
Big Looney Cr.....	2.20	33.80	61.00	3.00	.552
Coldiron Br.....	1.80	31.60	63.20	3.40	1.181

COKE.

	Moisture	V. C. M.	Fixed C.	Ash	Sulphur	Phos.
Big Looney Cr.....	2.50	92.30	5.20	0.72		.010

The Keokee Bed. This bed has been named Kellioka by the U. S. Geological Survey; is the Darby, or No. 5, bed of the Pocket; the McConnell east of there to Wise county; and then is the Taggart, or Roda, bed. A new name can hardly add to the confusion, and the above is adopted because mining in this bed in Kentucky is likely to occur first by the Keokee mines working across the State line, possibly before this report can be published.

The bed lies 160 to 180 feet above the Harlan bed, and, although of less area, is nearly, if not quite, of equal value to it in this region.

Near Harlan in both Black mountains the coal is too high and thin to work, appearing, in part, as a slaty cannel.

On Jones' creek it has 3½ feet of coal without parting. On Yokum creek it runs generally from 3 to 4 feet thick

without parting, though on Pounding Mill branch it has a 10 inch parting.

On Bailey creek it shows over 3 feet of solid coal with more above which is mixed with shale, but thence to Seagrave creek it has only been found too thin to work.

On Seagrave it has 3 feet and more of solid coal, of which the top is nearly cannel coal, and a little other separated by partings.

On Steep Hollow branch, $\frac{3}{4}$ miles above Seagrave, is $1\frac{1}{2}$ feet of cannel coal with an equal parting below it and then 3 feet of soft coal. Across Clover fork is 5 feet of coal, the top cannel, with two partings, but above this place nearly to Child's creek it has not yet been found in workable condition.

On Child's creek, Right fork, and near the mouth of the creek, the lower bench of the bed is about 3 feet thick: On the the Left fork and main creek but $2\frac{1}{2}$ feet, and the Darby mines, across Little Black mountain, yield generally, $2\frac{1}{2}$ to $3\frac{1}{2}$ feet of coal without parting.

From Child's creek to Breeding the lower bench of the bed is 2 to 3 feet thick, the remainder of it, sometimes present and sometimes not, (as is the case all along on Clover fork) being unavailable because of its partings.

At Breeding creek the coal goes below drainage, but it appears again on Rockhouse creek, and in the banks of Clover fork farther up, about 2 feet of solid coal. At $1\frac{3}{8}$ miles above Rockhouse creek it appears as $2\frac{1}{2}$ feet good cannel, but remains such for but a very short distance.

On the north of Clover fork two miles above Rockhouse it has over 4 feet of workable coal, and again above Head's creek nearly 4 feet, while on the south side it shows bad partings.

On Lauder creek it again shows nearly 4 feet of coal with partings small, and on the south of Clover nearly $3\frac{1}{2}$ feet without partings. From this point on to where it goes under Clover fork, a half mile above Razor, the bed continues, with much variation of partings and some exceptions, to improve until it becomes a nearly solid $4\frac{1}{2}$ to 5 feet of coal.

Across the mountain at the Keokee mines the coal

runs 5 to 7 feet thick with but 2 to 4 inches of parting at this writing, but eastward the main parting increases somewhat.

On Poor fork the bed has not been identified below English creek, where it has nearly 5 feet of coal without parting (U. S. G. S.) At Long branch this bottom bench is reduced to $3\frac{1}{2}$ feet, but on the adjacent Mill branch it is about 5 feet thick and on Straight branch over $4\frac{1}{2}$ feet.

On Lick branch its coal is cannel nearly $2\frac{1}{2}$ feet thick, if correlation is correct. On Jack branch it appears to be thin, but may not have been found.

From Jack branch to Clover Lick creek the bed is not known with certainty. A 5-foot coal with two partings, and the Branson 5 feet entry on Clover Lick are preferably referred to the Leonard bed.

On Pounding Mill branch, Clover Lick, one bench of the bed has 28 inches solid coal, and farther up Clover Lick a bed having $3\frac{1}{2}$ to 5 feet workable coal is referred to the Keokee.

On Big Looney creek the bed is apparently uniformly 4 to $6\frac{1}{2}$ feet of coal with no bad parting. It goes below drainage about 5 miles up the creek.

On Little Looney creek, Va., it has $4\frac{1}{2}$ feet of coal with a small parting and on Preacher creek about 5 feet of coal, of which 20 inches is cannel.

From Big Looney creek to Oven fork the bed maintains great regularity with thickness of coal diminishing to 3 and $3\frac{1}{2}$ feet on Lewis creek and then ranging from 3 to 4 feet. Partings are usually absent, and nowhere serious.

On Smith creek the bed becomes more split and with less coal. It appears not to have been opened above that stream.

On the south side of Big Black mountain the bed is mined at Roda with about 7 feet of coal.

This Keokee bed closely approximates, if it does not exceed, the value of the Harlan coal in this region. With most of its area carrying over 3 feet of clean coal and with the possibility of mining it successfully down to a thickness of 2 feet, or even less, as is said to be done at Darby, there seems to be no necessity for abandoning any of it, and

when thickest, with its convenient height above drainage it should prove most profitable. The coal is more or less mixed with splint through much of the region, but where 5 feet or more in thickness, and with little parting it is characterized by a layer of splint coal ordinarily about 8 inches thick a foot or less from the top.

The common coal of the bed is somewhat hard and rather brittle, so that in mining a less proportion of lump coal is produced than its appearance would lead to expect.

Analyses of the coal in Kentucky and in Virginia show it to be uniformly excellent and several years marketing of the Virginia coal confirm this. The Darby coal is reported as selling for 40 cents per ton more in Illinois than the block coal there. The coal from Keokee is rated especially high for gas.

Early tests made on Clover fork indicate a good coking coal there and the coke made commercially at Keokee is more than satisfactory, though it is reported of the Darby coal that it is too dry there for such treatment. Much of the Roda coal has been coked at Osaka.

KEOKEE COAL ANALYSES.

Location	Moisture	V. C. M.	Fixed C	Ash	Sulphur
Frank's Cr.....	1.44	33.56	62.80	2.20	.849
Seagrave Cr.....	1.52	34.88	60.70	2.90	.615
Steep Hollow.....	1.56	42.64	46.48	9.92	.574
Huff's Cr.....	1.35	33.90	58.93	5.28	.584
Little Trace Br.....	1.40	32.00	62.30	4.30	.712
Head of Clover.....	1.80	34.00	59.68	4.52	.473
Turkey-Pen Br.....	2.30	31.50	61.60	4.60	.560
Big Looney Cr.....	5.70	32.90	58.80	2.60	.425
Big Looney Cr.....	1.46	35.34	61.80	1.40	.497
Coldiron Br.....	2.40	31.70	63.70	2.20	.312

KEOKEE COKE ANALYSES.

Location	Moisture	V. C. M.	Fixed C	Ash	Sulphur	Phos.
Head of Clover..	1.60	.....	90.00	8.40	.257	.....
Big Looney Cr..	2.60	.....	94.48	2.77	.443	.013
Big Looney Cr..	5.30	.....	92.10	2.60	.41	.007

Close above the Keokee bed is another, here called the McKnight bed, of little importance, especially to be noted because, like the Leonard bed, it is liable to be confused with the Keokee. It is greatly variable, having, in an exposure on Clover fork, Steep Hollow, no less than nine partings with a total of but about 4 feet of coal, while on either side it soon disappears altogether. It is wanting over much of the region and is known in workable condition only on Clover Lick and Big Looney creeks. On the former in a single opening of 3 feet coal, and on the latter in several places 3 to 4½ feet coal with no partings exceeding 1 inch. If the more valuable Keokee coal is mined first the upper bed will be ruined

Following is an analysis of this coal:

MCKNIGHT COAL.

Location	Moisture	V. C. M.	Fixed C	Ash	Sulphur
Big Looney Cr.	9.60	30.20	50.12	10.08	.560

The Low Splint Coal. This bed, like the Keokee, is the middle one of a group of three, lying so near each other and so nearly alike that they are easily mistaken one for the other. In some places a fourth bed is added to the group, and over much of the region the outcrop of but one or two of the beds has been found. In such cases that one appearing most probably the Low Splint bed is assumed herein to be it, though its identity is not established.

It is to be noted, also, that that bed directly under the Low Splint is sometimes characterized by a considerable thickness of cannel coal and cannel slate as found on Fugitt creek, and opposite on Poor fork. Indications of the same have been found elsewhere.

The bed lies 200 to 250 feet above the Keokee coal, and appears to correspond most nearly with the Creech coal of the U. S. Geological Survey report on the Upper Cumberland River region.

Although opened at several points on the south of Clover fork between Harlan and Yokum creek with a

thickness of coal of 3 to 4 feet, with little or no parting, the bed has not been identified on Yokum, nor on Clover fork below Bailey creek. On the latter it has $2\frac{1}{2}$ to 3 feet of coal.

It is next found on Joe's branch, with 3 feet of coal, reported; and opposite the mouth of Fugitt creek with 5 feet of coal and two partings, also reported.

On Child's creek it has nearly 3 feet of coal, but beyond to Rockhouse creek it is ruined with partings.

On Rockhouse it has 3 to $4\frac{1}{2}$ feet of workable coal, but it becomes thin again immediately above that creek.

From Heads creek up to where the coal goes under drainage on Razor and Clover forks, the bed carries generally 4 to $4\frac{1}{2}$ feet of workable coal, Little Trace branch, opposite Razor fork, being excepted. On the south side of Little Black mountain the coal appears to be quite as thick where investigated as on the north side.

On Poor fork the bed has not yet been found of value below Big Looney creek, nor has it on that stream unless possibly at one opening near its head.

Not until Collier creek is reached does it promise well, perhaps because of meager search, two openings there giving 3 to 4 feet of coal with small parting.

On main Franks creek it reaches $3\frac{1}{2}$ feet, but its partings there are injurious and eastward to Smith creek the bed diminishes.

The name given to the bed is not justified by the proportion of splint coal it carries, but as it is known by no other, except as No. 6 at Darby and as the E bed, locally on the two forks, the name Low Splint is retained here.

The few analyses made of the coal show it to be of good quality, as indicated in the one given below.

Though available for coking it is likely to be used raw to a large extent, as the beds under it furnish coal better suited to that purpose.

LOW SPLINT COAL ANALYSIS.

Location.	Moisture	V. C. M.	Fixed C.	Ash	Sulphur
Lau der Cr.	5.012	35.548	52.002	6.785	.653

The Dean Coal. This bed has long been known in the Jellico and Pineville region under the same name. Above Pineville it is called the Wallen's creek coal by the U. S. Geological Survey; and on the Kentucky river it is quite generally known as the Fireclay coal. (See Bulletin 11, Ky. Geol. Survey.)

Its fireclay parting, though not constant in this region, serves to identify the bed without question wherever the clay is found.

The bed is about 400 feet above the Low Splint, too high on the mountains to have received much attention except for its aid in correlation, and it is generally too thin for mining in this region.

In Little Black mountain from Jones' to Day's creek, inclusive, the bed is at its best, showing usually 3 to 3½ feet of coal, but at all points with one or two partings which lessen or destroy its value.

Its 3½ feet of coal on Day's creek and a few inches more across the mountain on the the head of Gin's creek gives its most favorable condition.

On neither side of Big Black mountain has the bed been found workable.

DEAN COAL ANALYSES.

Location	Moisture	V. C. M.	Fixed C	Ash	Sulphur
Kitts Br.....	7.102	34.028	49.144	8.880	.846
Seagrave Cr.....	4.64	29.16	55.20	11.00	.986
Child's Cr.....	2.20	33.52	55.72	8.56	.656

The Limestone Coal. This bed is given its name because of its proximity to the fossil limestone above it. It is doubtless the Smith coal, 11 to 13 feet thick on Gray's knob, Martin's fork, although its interval from the Dean coal is greatly increased there, being 300 to 400 feet. It is 50 to 100 feet below the fossil limestone.

On one head of Yokum creek the bed has 6½ feet of coal with but two moderate partings, but on other heads it is so much cut up with many partings as to become practically worthless and to appear as two or more dis-

tinct beds. It is found compact, however, across the divide, on Bailey Trace, and in view of its thickness the possibility of its developing as workable coal here, notwithstanding its height, is not unpromising. On Seagrave creek, too, it shows $4\frac{1}{2}$ feet of coal with small partings.

On Child's creek it presents two beds 15 feet apart containing $3\frac{1}{2}$ and 5 feet of coal with small partings. On Kanah Winn branch it has over $3\frac{1}{2}$ feet of exceptionally handsome splint coal. Elsewhere on Clover fork it is not known to be of value but the bed is sometime particularly difficult to find, and little search for it has been made.

On Poor fork the bed has not been discovered below Big Looney creek, and on that stream only near its head, where it is found 4 to 6 feet of coal with small parting.

On Franks creek, at the head of Blair fork, it has $9\frac{1}{2}$ feet of coal with little or no parting, and on Smith creek, perhaps two miles east of the Blair fork opening, $5\frac{1}{2}$ feet of clean coal.

On the south side of Big Black mountain at the head of Potcamp (Whitley) fork the bed shows in two openings 10 feet of nearly clean coal, and like results are reported of other openings in the vicinity. In these thick openings the coal shows a remarkable uniformity of character, considering the usual variations of the region. Hardly any change can be detected throughout the bed. It is fairly bright coal, not hard, inclined to crumble, having every appearance of a good coking coal.

The composition of the coal is shown in the following analyses:

LIMESTONE COAL ANALYSES.

Location.	Moisture	V. C. M.	Fixed C	Ash	Sulphur	Phos.
Child's Cr. - (Upper Split)	3.806	37.649	53.486	4.320	.739	.....
Child's Cr. (Lower Split)	2.00	36.80	55.86	5.34	.958	.....
Big Looney Cr..	3.00	31.40	56.30	9.30	.604	.....
Big Looney Cr..	3.20	28.06	60.44	8.30	.541	.....
Oven Fork.....	2.93	33.54	54.12	9.41	.75	.051

The Cornett Bed. This little known bed, takes its name from the owner on whose land it was found next the bottom one of a group of four or five beds. All of these show thicknesses of 3 feet or more of coal, but because of their height the Cornett and the upper one alone are considered workable. The two are so much alike and lie so near together that it has not been possible always to distinguish one from the other, nor where thin can the Cornett bed always be distinguished from one of its near neighbors without more development than is yet accomplished. The bed lies 100 to 200 feet above the fossil limestone, an increase eastward of thickness of strata being evidenced on Big Black mountain near the head of Fugitt creek.

But two openings into the bed are known on Little Black mountain, both of them on Seagrave creek, where the coal has $3\frac{1}{2}$ feet or more of clean coal.

On Big Black mountain the nearest opening to Harlan is probably on Bailey creek, Clover fork, but the thin coal found there is of doubtful correlation.

On either side of the head of Straight branch, Poor fork, it gives about 4 feet of coal with two (or three) partings: On Garner and Island branches about 7 feet of coal including 7 inches cannel.

On Fugitt creek, Clover fork, it shows again 4 feet of coal, and on Breeding $3\frac{1}{2}$ feet, both openings without parting, and on Heads creek $6\frac{1}{2}$ feet with small partings. On Lauder creek 6 feet of coal with $1\frac{1}{2}$ feet parting has been reported, supposed to be of the Cornett bed. East of this point the bed is not known to have workable coal.

Following are the only known analyses made of this coal:

CORNETT COAL ANALYSES.

Location.	Moisture	V. C. M.	Fixed C	Ash	Sulphur
Garner Br. (51 in. Seam)...	6.08	32.72	58.20	3.00	.311
Garner Br. (23 in. Seam)...	1.90	36.00	56.10	6.00	.461

The High Splint Bed. This bed, lying from 40 to 80 feet above the Cornett, and from 200 on Fugitt creek to 350 on Clover Lick and Big Looney creeks above the fossil limestone, overreaches most of Little Black mountain, and is so high on Big Black that it has not received the consideration which is its due because of its thickness and quality. On this account a series of openings into it were made by the State Survey from Bailey creek to Clover Lick, and on Lewis and Collier creek, where it had previously been practically unknown. Though high it is still 500 to 700 feet below the top of Big Black over a large area, the crest of the mountain being generally rather blunt. This is illustrated by the picture, Plate II, of part of the "Morris farm" at the head of Razor fork, elevation about 4,000 feet.

But also on Little Black the bed has a considerable area between Jones' and Day's creeks with a thickness opened to 5 and 6 feet on Seagrave and to 4 feet on Child's creek.

The Big Black openings begin at Bailey creek (west of which the bed can have but an unimportant area) with 5 feet of coal having one parting. Near the head of Straight branch unfinished openings show $2\frac{1}{2}$ to 4 feet of coal. They should not be regarded as giving the thickness of the bed, but the coal is cut out at Clover gap and the field here is of less area than an equal length farther east.

The next opening, on Joe's branch, Clover fork, has 9 feet of coal with little parting, the maximum thickness of coal yet found in this bed. On Fugitt creek is 3 to 4 feet of clean coal, on Kanah Winn branch 4 feet, and on Breeding creek 6 feet clean. On Head's creek it is not quite 4 feet, but is up again on Huff's creek to $5\frac{1}{2}$ feet.

On the head of Clover fork, on Razor fork, and on Clover Lick and Big Looney creeks in Kentucky, and Little Looney Creek in Virginia, in all over fifty openings into the bed have been made, none of them giving less than 4 feet of coal and varying from that up to $7\frac{1}{4}$ feet, while the average thickness, including some unfinished openings, is slightly over 70 inches. Few of the openings

PL. II.



MORRIS FARM, HEAD OF RAZOR FORK.

show a parting, and but two of them, adjacent, in excess of 4 inches.

East of Big Looney creek the bed was followed with considerable difficulty and some uncertainty. If correlation is correct, it has on Lewis creek but 3 feet of coal; on Collier 3 feet; and on Frank's creek $4\frac{1}{2}$ feet. East of this creek its area is not so large as to induce early exploitation of the bed.

The bed lies over one thousand feet above all points which can be reached by steam railroad, and the expense of delivery of its coal to the latter detracts materially from its value, yet not so much, it is believed, as should deter early production. For better realization of the quantity of coal contained in the bed an estimate has been made of that available in a distance of about three and one-half miles along the mountain, from Garrison gap, at the head of Clover Lick, to the westerly gap between Big and Little Looney creeks, nearly the whole outcrop having been surveyed there. The resulting area amounts to about 5,000 acres, which, with an average yield of $5\frac{1}{2}$ feet of coal gives 33,000,000 tons, allowing 1,200 tons per acre for each foot of thickness.

Though the area thus obtained is greater than can be found in a like distance elsewhere along the mountain, the coal available between Clover and Garrison gaps, nearly fifteen miles, is probably several times the above calculated amount. The mountain, valleys and coal-bed decrease westward in altitude simultaneously, and the spurs on the southern side of the mountain abut steeply against Clover fork nearly to the height of the main ridge.

But if quantity of coal alone were considered the bed would lie long intact. Its superior quality renders it of present consequence.

This is shown in part by the analyses given below, but added to this is the fact that it is largely a fine splint coal which withstands weathering indefinitely. Lumps which have lain in the dump from the opening for ten years show no appreciable deterioration.

What proportion of the coal is splint cannot yet be determined, for openings need to be driven underground

to show fully the character of the coal. On the head of Razor fork, where this has been done, the whole bed became splint coal, while other openings generally have shown the lower half or more (less exposed than the rest) as splint.

The following are representative analyses of this coal:

HIGH SPLINT COAL ANALYSES.

Location.	Moisture	V. C. M.	Fixed C	Ash	Sulphur
Seagrave Cr.	3.10	36.10	56.60	4.20	.794
Fugitt Cr.	1.56	35.04	60.80	2.60	.835
Child's Cr.	3.50	35.80	55.97	4.73	1.027
Kanah Winn. Br.	1.80	37.10	56.70	4.40	.964
Razor Fork.	4.45	36.27	56.05	3.23	.54
Clover Lick Cr.	2.60	35.60	58.60	3.20	.491
Big Looney Cr.	2.30	33.30	57.20	7.20	.502
Big Looney Cr.	4.36	35.02	56.92	3.70	.67

COKE.

Location.	Moisture	V. C. M.	Fixed C	Ash	Sulphur
Big Looney Cr.	0.30	1.21	93.26	5.23	.41

The highest coal of workable thickness, 540 feet above the High Splint bed, at Sourwood gap on the head of Pounding Mill (?) branch, Clover Lick creek, is shown in figure 2. It, also, is a fine splint coal at this, its only opening, reported 4 feet of coal without parting. Its height and small area preclude mining.

Besides the coals enumerated are many small seams occurring throughout the section, sometimes attaining a thickness of 3 feet, but of very doubtful utility, as such thickness is much restricted in area. They are shown, wherever found, in the detailed description following.

The extreme irregularity of the coal beds, both as to thickness of coal and number and thickness of partings makes any generalization of them difficult and of little value. It may be said, however, that over most of the area south of Poor fork the Harlan bed will yield 4 to 6 feet (and more) of coal, that the Keokee bed will possibly average 4 feet over an area but little less. Other beds, it is believed, will increase the total yield of the whole area south of Poor fork by 3 to 6 feet.

STRATIGRAPHY.

The conglomerate base of the coal measures, consisting of three to five distinct sandstone cliff-forming members, with some shale and coal between them, is exposed all along Pine Mountain, the bottom of the formation generally a little north of the mountain crest, the top dipping under Poor fork along its upper half at least. Intermediate strata are exposed in the mountain ravines. Just how much to include in this formation is still a matter of doubt.

What appears to be the top of the cliff rock is exposed at various points along the road up Poor fork, and at Straight branch an attempt was made to find the thickness of strata between it and the Harlan coal. From the Harlan coal to Poor fork the thickness is about 850 feet, to which must be added, say, 200 feet for the thickness across the 100 yards of bottom land between the stream and base of mountain, making 1,050 feet total, an estimate believed to be fairly approximate.

But, inasmuch as there is a pebble rock of the lower series far above this cliff rock, it seems that it and all included strata should be considered a part of the Lower Conglomerate. Opposite the mouth of Robert's branch pebble rock was found but about 260 feet below the Harlan coal. This thin friable pebble sandstone has not been seen elsewhere in the region, but it resembles closely one found at the Dorchester railroad trestle below Norton, Virginia, estimated to be seven to eight hundred feet below the Harlan coal.

There is some slight evidence that the pebble rock is even within fifty feet of the Harlan coal. This lies in the loose pebbles found lying just below the bed between Clover Lick and Big Looney creeks (page 165) on Meadow branch (page 206) and at Partridge post office (page 212) all too high above Poor fork to have been washed there in any recent time, and so corresponding in position as to make suspicion strong that the pebble rock lies close under the Harlan coal.

If such is the case and the presence of pebbles in the rock is accepted as a mark of the Lower Conglomerate

formation a great thickness of rocks heretofore attributed to higher formations must now be included therein. And this view is strengthened by the "discovery of Pottsville plants in the upper part of the Norton formation in the Bristol quadrangle"* which "led to the conclusion that the top of the Pottsville must be placed much higher than was at first thought possible."

The Lower Conglomerate, or Pottsville, formation then may include all of the Lee and Hance formations of the U. S. Geological Survey on Upper Cumberland river, and all of the Lee and Norton, and part of the Wise formations, to above the (Powell river) Imboden coal, as described in the Bristol quadrangle.

The sandstone directly under the Harlan coal is strongly marked by a honeycomb weathering on Lower Clover fork and again on Big Looney creek to less extent, and on the Big Sandy river waters this is a marked feature of the sandstone under Coal 1. But correlation on that account is not conclusive. An unusually fine honeycomb exhibit can be seen from the road down Line fork below Hurricane gap in rock perhaps 100 feet below the Dean coal, and lesser displays of that feature occur throughout the series.

A possible aid in correlation may be found in a thin bedded sandstone lying 60 to 80 feet below the Harlan coal, which seems to be quite persistent, but does not differ in appearance from other thin bedded sandstones. It is generally about 3 feet thick, and splits into half-inch to four inch plates, soft until exposed when it becomes quite hard. It is used for chimneys, grave stones and flagging. It is noted later at various points where found.

A heavy sandstone overlies the Harlan coal near Harlan town, but elsewhere the bed is largely characterized by a predominating shale. (As is Coal 1 of Northeastern Kentucky.) This shale with the hard sandstone under it gives a striking topography, where the intervening coal is not far above drainage, which is not noticeable elsewhere in the region. It is evident in the long low ends of spurs with rounded tops and frequent gaps, the coal often lying at the gap level, sometimes above the peaks.

*Professional Paper, No. 49, U. S. G. S., P. 206.

This feature, very pronounced on Crummies creek, shows but slightly on Clover fork. A tendency toward it is visible at intervals from Ages creek to Seagrave, where the coal is close to water level. On the south side of Little Black mountain it is very conspicuous, perhaps nowhere better illustrated than about Keokee.

On Poor fork it is probably first seen in the high knob standing out in the line of the valley in the vicinity of Creech post-office; again, on Clover Lick and Looney creeks near Poor fork, and frequently above Looney creek, most evident about Partridge post-office.

Below and above the Keokee bed are also sandstones which give characteristic topography, though it would be hardly noticeable on Clover and Poor Forks were it not remarkably plain and frequent on the south side of the Black mountain. These sandstones run out in long nearly level and very narrow spurs generally without, or with very small, gaps—the soil is particularly prolific of laurel and rhododendron.

Massive sandstones predominate, but are of doubtful utility in correlations, up to about 60 feet above the Low Splint coal. Thence to within 300 feet of the High Splint, some 800 feet total, is a series of generally thin bedded shales, sandstones, occasional limestones and irregular coals, including the Dean and Limestone coal beds.

Especially noteworthy among these is a fossil limestone lying 50 to 100 feet above the Limestone coal, believed to be the highest of the limestones of this region. Like the others it is nowhere more than 3 feet thick, and varies from that down to nothing. It generally, even when thin, has a blue or grayish hard base, in which are scattered small fragments of shells, covered by a nearly equal thickness of dark slaty stone usually abounding in fossils, many showing the shells in perfection. Once known it is easily distinguished from the barren limestones frequently found below it, but the presence of a second similar bed on the head of Kentucky river, South fork, and on the adjacent Straight creek, Left fork, leaves room for doubt if some of the discrepancies in interval between this bed and the

High Splint, detailed later in this report, may not be due to the appearance of this second bed.

Analysis of this limestone is given on page 156. It is unknown on the south side of the Black mountains in Virginia, except at one point on Pot-Camp fork, where it is more of a sand- than lime-stone and is nearly white.

Massive sandstones occupy most of the section from 300 feet below the High Splint coal to 50 to 80 feet above it. A few pebbles have been found in these rocks down to 150 feet below the coal, and they appear to increase in size and abundance upwards. Boulders supposed to have come from the vicinity of the coal often show them as profuse as usual in the Lower Conglomerate, but in the cliffs they are rarely found other than scattering. For a few miles about the head of Clover fork, too, they seem to be more abundant than elsewhere.

The Jesse sandstone of the Log Mountain region (U. S. Geol. Survey) is included in these rocks, probably at (or near) their top, because of the greater abundance of pebbles there. If below the top, that most prominent member of this group of rocks in the Poor Fork region seems to disappear farther west, and the High Splint and associate coals can be correlated with some degree of certainty with the Hignite coals of Log mountain.*

The change from this hard Upper Conglomerate formation to the softer rock above it causes the rounding top to the Big Black mountain previously referred to. Numerous streams having their source near the top descend gradually till they reach this formation and thence pitch rapidly down it. Spurs likewise show the same change of slope as may be seen, somewhat indistinctly, in the picture opposite page 196. The High Splint coal is opened about where Fickles ridge, in the center of the picture, meets the short spur to the right, and its outcrop cuts across the two gullies shown by dark bands near the point of the ridge, the change of slope, marking the end of the ridge-top indicating the top of the conglomerate. Familiarity with this condition aids greatly in locating the High Splint outcrop.

*Mr. Crandall correlates the Hignite coals with the Dean beds. See Bulletin 14.—C. J. N.

There is also a marked change at the top of this formation from a rather coarse sandstone below to a fine grain above, the latter prevailing in all the sandstones to the top of the mountain.

A brown sandstone containing pebbles was found probably about 250 feet above the High Splint coal at one point on Big Black mountain.

Correlation with Kentucky River Coals.

Correlation of the coals of this region with those adjoining on the Cumberland river and on the south in Virginia having been incidentally referred to in the preceding pages, it remains to make connection with those to the north.

Though the narrow Pine Mountain alone breaks the continuity of strata, there is such a change in their thickness on the two sides of that mountain, that much uncertainty has existed hitherto as to correlation, and still only a beginning in that direction has been established.

North of Pine mountain, opposite the region under discussion, there is but one point near the mountain where a section has been obtained showing the place of several typical beds with certainty. This is in the vicinity of Whitesburg, and, in Figure 5, the cross-section showing Big Black mountain beds has been carried across to the mouth of Sand Lick creek that the relation of the beds in the two localities may be clearly seen.

If, as now seems probable, the Harlan coal is the same as the Rockhouse bed of Kentucky river (the No. 1 of early State Survey) the interval to the Dean coal, now positively recognized on both sides of Pine mountain, is reduced on the north by about 300 feet. If the Imboden or a lower coal corresponds with the Rockhouse that reduction is, of course, much greater.

Of the beds intermediate between the two no data have been obtained for certain correlation, but the similarity of the Keokee coal to the Elkhorn, in thickness, continuity and general character, both now well known com-

bined with its relation to the beds below and above it, render extremely probable the supposition that they are the same bed.

From the Dean coal to the fossil rock above is a still further reduction northward of thickness of strata amounting to about 150 feet.

The Limestone coal bed, with its 10 feet of nearly clean coal in Big Black mountain, can hardly be other than coal of similar thickness on Irishman creek, Carr fork, near Hindman, about 300 feet above the Dean coal, though on that creek and elsewhere on Kentucky river waters another thick coal intervenes between those two beds.*

The 450 feet reduction north of Pine mountain of thickness of strata above the Harlan coal is far exceeded below that coal. Assuming the Harlan to be the No. 1 Coal, all of the 1,050 feet found below it on Straight branch, Poor fork (page 147) down to the Pine mountain conglomerate is wholly wanting on the edge of the coal field farther north, as near Jackson, for instance, and the unknown thickness of that conglomerate, several hundred feet, is represented by less than 100 feet in that vicinity. The total reduction then amounts to nearly 2,000 feet in a distance of some 40 to 50 miles.

*Reference is to the bed termed the Hindman Coal in Bulletin 11 (Coals of the Three Forks of the Kentucky River).—C. J. N.

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NOTES IN DETAIL.

In the following pages notes in detail are given in geographical sequence from the mouth of Clover fork to its head and from the mouth of Poor fork to its head.

Distances along Clover fork are derived from railroad survey. On Poor fork to Big Looney creek from milestones, and thence to the head from maps or other less reliable information.

The railroad survey furnished accurate sea-level elevations of Clover fork to Razor fork, and from these by barometric readings, generally repeated, other elevations along that fork were obtained. On Poor fork (as on Clover) precise levelling was carried some 10 miles up the creek by the U. S. Geol. Survey, and thence onward barometers were depended upon for the elevations here given.

The notes given herein are mainly from my own work in the region at intervals during the last eighteen years, including six weeks for the Kentucky Geological Survey with Mr. J. H. Gardner as assistant, and subsequent field work. To these are added notes furnished by Mr. R. C. Ballard Thruston, acquired during twenty-five years, the earliest being for the same State Survey. Mr. Gardner's work is designated in the following pages by the letter G. Information obtained from outside sources is so specified.

The section of figure 1, page 3, represents the principal features of the strata exposed in and near Harlan town with correction made for dip in its lower half. The thin coal at the bottom of the section crops out at water level of Clover fork a few yards above the fall near the mouth of the stream, and the thinner coal, about 30 feet higher, on the flat in the main part of the town.

These coals are supposed to represent the Imboden coal, mined extensively between Big Stone Gap and Norton, Va., and the Kelly coal above it although the interval here to the Harlan coal appears to be 50 to 80 feet more than there, and the coals show no indication of the value they have there. There is no coal nearer the Harlan in this vicinity which more resembles the Imboden, and the hard sandstone in the bed of Clover is somewhat indicative of that below the Imboden in Virginia. An unusually hard sandstone, 6 inches thick, underlies the upper one of these coals in Harlan town.

The lower honeycomb sandstone is conspicuous in the cliff quarried opposite town, by the road just above town and at several points along Clover fork up to Ages creek. The upper honeycomb shows this structure mainly in the upper half of its thickness. Its cliffs are first noticeable from the road near the mouth of Yokum creek, and thence up to Seagrave creek where it is mostly below drainage.

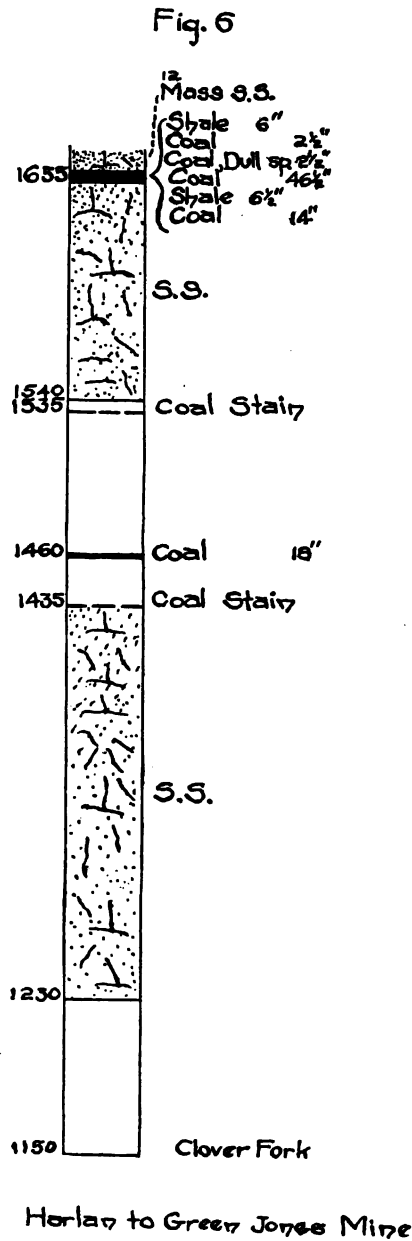
The Harlan coal has been mined in many places about town, about to be enumerated, but the Keokee (Kellioka) is probably both too high and too thin to have received notice in this close vicinity, and the higher coals, also unopened here, are certainly too high for early use.

RANSOM HOLLOW.

On the right, $\frac{1}{4}$ mile up Clover fork.

The following section was obtained here:

Cannel shale.....	20"	} El. 1835
Coal.....	14"	
Black slate.....	$\frac{1}{2}$ "	
Coal.....	10"	
45' Sandstone.....	1785	
35' Sh. S. S.....	1740	
65' Sandstone.....	1675	



S. S.	
8' Shale.	
Coal.....	4"
Dull splint coal.....	4"
Coal.....	44"
Shale.....	7"
Coal.....	13"
Clover Fork.....	1145

The coal at elevation 1660 is the Harlan of the J. L. Smith mine, the abandoned Baker mine being 50 yards east of it, while that at 1835 is probably the Keokee, though its cannel shale is rather indicative of the Leonard bed. The intermediate sandstones occupy nearly the whole space between.

An opening by Felix King, on the left one mile up Martin's fork, unfinished when visited in 1904, showing 14 inches of bottom coal, 5 inches of parting and 51 or more inches of top coal, and an entry on Crummies creek with 6 feet of coal, almost clear of parting, promise improvement in the bed, working southwest from Lower Clover fork.

The section of figure 6, taken by Mr. Thruston on the right of Clover fork at the upper end of Harlan, is uncorrected for dip, which cannot affect the section greatly as the dip is slight and the hillside steep.

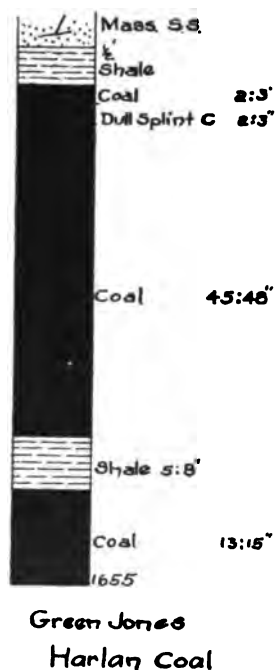
The "Cawood" sandstone is shown here with the lower one of three small coals lying on it. These coals, so far as seen, nowhere on the fork exceed two feet in thickness.

The Harlan coal of the Green Jones mine, Fig. 6a, has been worked to a considerable extent for use in Harlan. The bottom coal is not mined, though it probably would be

in extensive working. The coal is apparently nearly uniform in character throughout its section, except for a seam of dull splint or bony coal near the top. This seam is found at most of the openings into the bed on Lower Clover fork.

The following analyses of the coal are, No. 2699 from sample obtained by Mr. Thruston, analyzed for the Survey by Dr. R. Peter, and, "McC." from a report to the Louisville and Nashville Railroad by McCreath and D'Invilliers, dated 1887.

Fig. 6a



HARLAN COAL		No. 2699	McC.
Moisture		1.68	1.700
Volatile combustible matter		35.72	36.993
Fixed carbon		60.20	57.674
Ash		2.40	2.870
		100.00	
Sulphur		.574	.763
			100.000
Color of ash		Light brownish gray.	Brown.
Coke		Dense.	

Dr. Peter remarks of the sample sent him: "A pure, pitch-black coal, breaking irregularly cuboidal with irregular shining surfaces. A very little bright pyrites, but no fibrous coal apparent."

On the right of Clover, $\frac{1}{2}$ mile up it, is the G. A. S. Kelly mine, Harlan, coal, of which the U. S. Geological Survey* gives the following thickness and analysis of a sample collected in 1902 by Prof. A. S. McCreath:

*This and subsequent items from the U. S. G. S. refer to Professional Paper No. 49.

MASSIVE S. S.		HARLAN COAL.	
4 ft. Shale		Moisture.....	1.314
Black shale..... 6"		Volatile hydrocarbon.....	38.626
Coal..... 1" : 2"		Fixed Carbon.....	56.402
Black Shale..... 6"		Ash.....	2.920
Coal..... 51"		Sulphur.....	.738
Clay..... 13"			
Coal..... 14"			100.00.

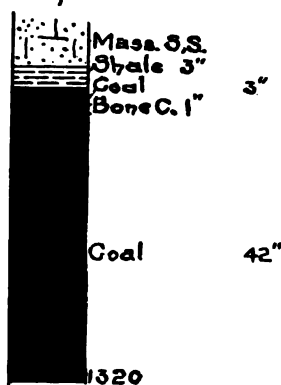
As in other mines now operating in this vicinity the lower seam of coal is not mined, and Prof. McCreath's sample therefore is supposed not to have included it.

Branch on the left $\frac{3}{4}$ miles up Clover; mouth of branch, 1150.

Ransom Turner has an opening, $\frac{3}{8}$ mile up and on the Left fork of the branch, giving this section:

	Massive sandstone.	In.
10'	Sandy shale.	
	Coal.....	5
	Dull Splint.....	1
	Coal.....	42
		Elevation 1540

Fig.7



James M. Huff
Harlan Coal

A half mile up, on the Right fork of the Left fork, James M. Huff has the coal shown in figure 7. Its analysis, from a sample taken by Prof. McCreath in 1902, according to the U. S. Geological Survey, is given below. There is a considerable northwest pitch to the bed at this opening, and later ones, adjacent, show but 18 inches and about 36 inches of coal, all of which indicates a roll here, doubtless of small extent. This coal seems to correspond in location as well as bed-section with that of the Pennington mine, given by McCreath and D'In-villiers in their report of 1887. Their analysis of that coal follows also:

HARLAN COAL.

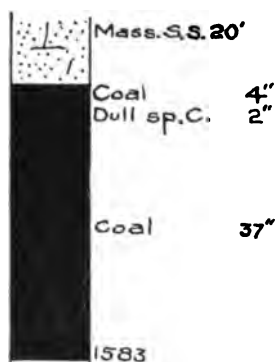
	Huff	Pennington
Moisture.....	2.176	1.350
Volatile combustible matter.....	38.124	39.980
Fixed carbon.....	55.971	52.200
Ash.....	3.100	2.680
Sulphur.....	0.629	.790
	100.000	100.000

Collor of Ash.....

Reddish-gray

An error of 3 per cent. is evident in the analysis of Pennington coal. If its correction should result in 55.200 per cent. of fixed carbon the analysis would come very close to that of the Huff coal.

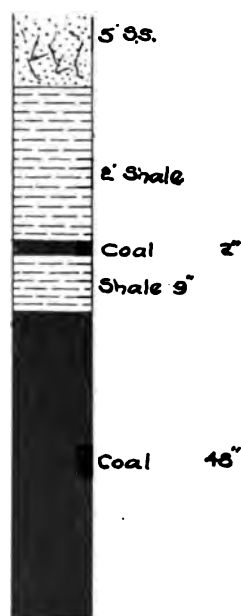
Fig. 8

Harlan Coal
B. M. Baker

On the left, about $1\frac{1}{4}$ miles up Clover fork, the B. M. Baker entry gave the section of figure 8. This is the thinnest coal noted of the several small mines which have been opened, with long chutes down to the road below, about opposite Kitt's branch, their average height above

the river being about 360 feet. Figure 9 gives the thickest coal measured there. The following analysis by Dr. R. Peter of a sample by Mr. Thruston from the George Turner mine is from one of these, now possibly under different name and with a new entrance.

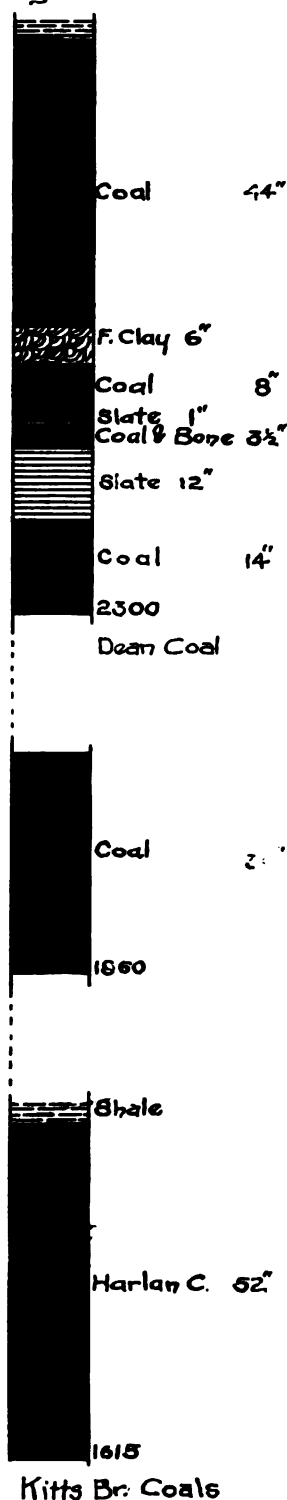
Fig. 9



Harlan Coal

HARLAN COAL.	No. 2679
Moisture.....	1.76
Volatile combustible matter.....	34.64
Fixed carbon.....	60.50
Ash (very light gray).....	3.10
	100.00
Sulphur.....	.904
Coke.....	Light spongy.

Fig. 10



"A bright pitch-black coal, fracture generally cuboidal and irregular. Very little fibrous coal apparent, but some granular pyrites."

KITT'S BRANCH.

On the right, 1½ miles up Clover fork; elevation of mouth, 1160.

The three coals found on J. B. Howard's land, on this branch, are shown in figure 10, as given by Mr. Thruston. The Harlan coal, at the bottom, has an inch of doubtful bone coal (dull splint) 6 inches from the top. The middle coal is of the low splint group, presumably its main member, a "hard, rich" coal. The top coal with its flint fire-clay parting is of the Dean bed, which being here 1,140 feet above Clover fork, and of irregular section along the fork, is of doubtful utility.

Of the two following analyses of Harlan coal No. 1825 is by Dr. R. Peter from a sample by P. N. Moore, taken for the Survey from the Howard mine. The other is from McCreath and D'Invilliers' report, in which the large proportion of water and ash obtained is ascribed to mud included in the outcrop sample. They say the coal should coke well. The sample of the Dean coal restricted to the 44 inches at the top, also analyzed by McCreath and D'Invilliers, was taken from the outcrop and the percentage of water and ash enlarged in consequence, but not to the extent of that in the Harlan sample.

Fig. 11.



HARLAN COAL. DEAN

	No. 1825	Mc. C.	Mc. C.
Moisture.....	1.70	7.886	7.102
Vol. comb. matter.....	35.70	34.329	34.028
Fixed carbon.....	59.60	52.065	49.144
Ash.....	3.00	5.125	8.880
Sulphur.....	100.00 .750	100.000 .595	100.000 .846
Color of ash.....	light buff	cream	light brown
Coke.....	very light spongy		
Specific gravity....	1.289		

No. 1825. "A bright pitch-black coal (semi-bituminous), having very little fibrous coal, and no visible pyrites."

HENSLEY BRANCH.

On the left, 2 miles up Clover fork; elevation of mouth 1165.

The lower coal of figure 11, the Harlan, on the left, $\frac{1}{4}$ mile up this branch was but partly opened when visited, and the thickness of the lower coal was uncertain, but evidently it was little more than given in the figure. It is the first appearance of the lower seam of this coal on the left of Clover fork.

The rather slaty cannel coal at the top of the figure is of the Keokee (possibly Leonard) bed, and is opened here first in going up Clover fork. The character of the coal is uncertain. Mr. Thruston in the same or a nearby opening called it 20 inches cannel with heavy covering of cannel shale.

Fig.12



The relative scarcity of openings into the Harlan coal above Hensley branch is attributed to the inconvenience of its delivery to town rather than to diminution of thickness, though at Martin Smith's, on the right, $3\frac{1}{4}$ miles up Clover fork, it has but 38 inches coal, as shown in figure 12.

The cannel bed of the same figure is evidently the same as that opened on Hensley branch, although the interval from the Harlan appears to be much less. This difference is accounted for by the dip of the coal.

The top bed of the figure is probably the Lower Splint, increased from 34 inches on Kitts branch to workable thickness here, although its height of 140 feet above Clover fork makes its utilization doubtful.

The Harlan coal is again opened at Jesse Gilbert's, on the left, $3\frac{1}{2}$ miles up Clover fork, (at the 25-26 mile post with increased section as shown in figure 13. And again, the U. S. Geological Survey notes an opening on the Harris place, on the left, $\frac{1}{4}$ mile above Gilbert's, with 40 inches coal exposed, and the bottom of the bed covered. This has 2 feet of shale roof under sandstone.

Fig.13

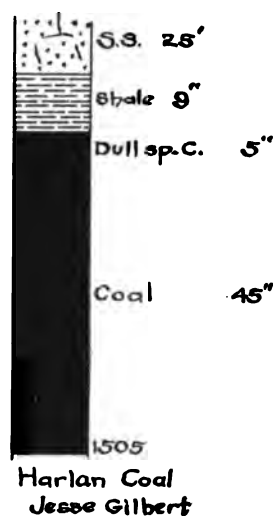


Fig. 14



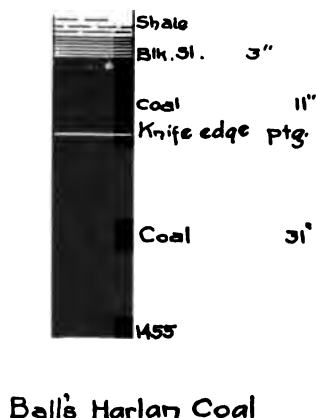
AGES CREEK.

On the left, $4\frac{3}{4}$ miles up Clover fork; elevation of mouth, 1205.

On the Left fork, $1\frac{1}{8}$ miles from Clover fork the U. S. Geological Survey reports the Harlan coal as in figure 14, but badly weathered. From a more recent visit this appears now to be the Ambrose Low opening, fallen in.

On the Right fork, a mile or more from Clover fork, McCreath and D'Invilliers found the Harlan coal as in figure 15, ten inches in the middle of the bottom seam being called "coal and bone". Although the opening was "in frightful condition" a sample of the coal yielded them:

Fig. 15



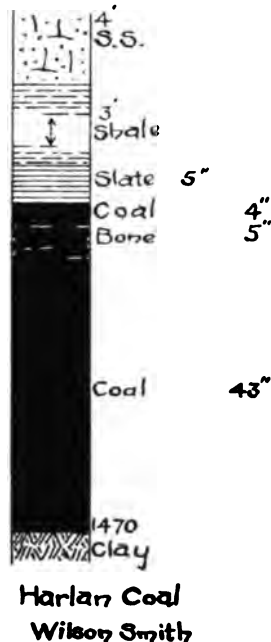
HARLAN COAL.

Moisture.....	1.544
Volatile combustible matter.....	36.869
Fixed carbon.....	53.57
Ash.....	6.740
Sulphur.....	1.275
	100.000
Color of ash.....	Cream.

On a recent visit probably to the same opening, Lloyd Ball's, though not driven under cover and with the bottom of the coal hidden by fallen earth, still 46 inches of solid coal was visible—the apparent impurities of the earlier time had disappeared.

Another Lloyd Ball opening, since fallen wholly in, gave to the U. S. Geological Survey but 42 inches of coal.

Fig. 16



On the left $5\frac{1}{2}$ miles up Clover fork is the Wilson M. Smith entry of figure 16 as obtained by my measurement. It is given by the U. S. Geol. Survey with but half as much bone and one inch less total coal. Analysis of a sample of the coal by Prof. McCreath gave, according to the U. S. report:

HARLAN COAL.	
Moisture.....	1.428
Volatile hydrocarbon.....	38.132
Fixed carbon.....	54.688
Ash.....	4.680
Sulphur.....	1.072
	100.000

GABES BRANCH.

On the right, 5 miles up Clover fork; elevation of mouth, 1210.

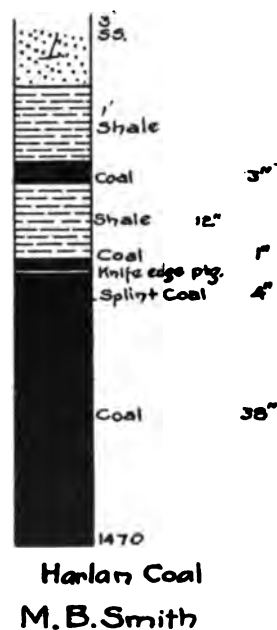
The M. B. Smith entry, at water level, a short half mile up the branch is represented in figure 17. It is but barely under good roof. The main coal is particularly hard and bright. An early measure gave the characteristic dull splint or bone coal an inch thick, 4 inches from the top.

JONES CREEK.

On the right, $6\frac{1}{2}$ miles up; elevation of mouth, 1230.

A half mile up Road branch, on the right a mile up the creek, the Harlan coal is opened, as given by the U. S. Geological Survey, with the

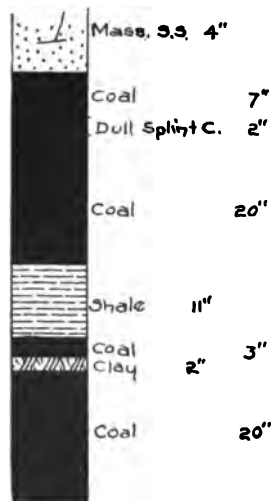
Fig. 17.



section in the first column below. Again, at George Steward's, $\frac{1}{4}$ mile up a right branch, probably the next beyond Road branch, is a 30 yard entry into the Harlan coal at elevation 1485 giving the section of the second column below.

HARLAN COAL.		15 ft. Massive sandstone.	
Hard sandstone.	In.	Coal.....	2
Sandy shale.		Bony splint coal.....	1
Coal.....	6½	Coal.....	3
Bone coal.....	1	Bony splint coal.....	1
Coal.....	18	Coal.....	37
Fire-clay.....	7"		
Splinty coal.....	3		
Coal.....	17½		
Clay.....	1½"		
Splinty coal.....	3		
Knife edge of shale.			
Coal.....	13		

Fig. 18

Wright Winn
Harlan Coal

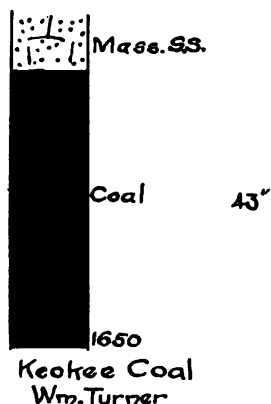
On the next right branch above Stewards, $\frac{1}{8}$ mile from the creek, is the Wright Winn 25-yard entry, with coal at its mouth as shown in figure 18. At the head of the entry this section is reduced to:

	In.
Coal.....	25
Shale.....	12"
Coal.....	19

At $1\frac{1}{2}$ miles up the creek, the U. S. Geological Survey reports 26 inches of coal between sandstones as probably of the Harlan bed, and the reduction in the Winn entry, of more recent date, tends to confirm this, the probability being that the bottom seam disappears, as shown to be the case near Harlan. This is the first indication on either side of Little Black mountain of failure of the coal of this bed, though east of this point it is a rather common occurrence.

On the left, also $1\frac{1}{2}$ miles up the creek, the same authority reports the Keokee coal with 24 inches seen and mine posts indicating a bed 5 to 6 feet thick.

Fig. 19

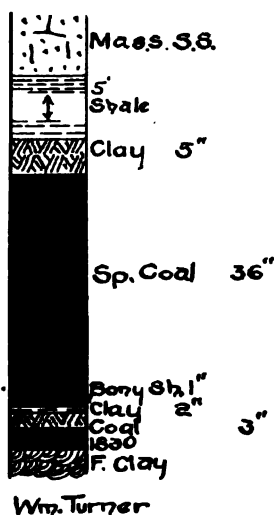


At $1\frac{3}{4}$ miles up, on the William Turner tract, the bed has 43 inches coal. Figure 19.

At 2 miles up, the U. S. Survey further reports what was thought to be the Low Splint (Creech) coal as in figure 20. My finding of 36 inches of coal with 2 inches parting in the immediate vicinity at elevation 1830, about right for the Low Splint, or bed below it, is rather confirmatory of that supposition.

At $2\frac{1}{3}$ miles up the creek Thruston found on Edward Jones' land at elevation 1640, and 3 miles up on Turner land at elevation 1850, coals with the following sections:

Fig. 20



KEOKEE COAL

	In.
Sandstone.	
Shale.....	6.8"
Fine hard coal.....	30
Bony Coal.....	2
Slaty coal.....	2

LOW SPLINT (?) COAL.

	In.
10 ft. Sandstone.	
Fossil shale (?)	
Cannel shale.....	6"
Coal (part splint and bone).....	36
Shale.....	4½"
Splint coal.....	2½"

There is much uncertainty as to the distances given on this stream, estimated at different times by different observers, and it is possible that the last two sections are from the same point as the two next preceding them, though they differ slightly in section.

Fig. 21

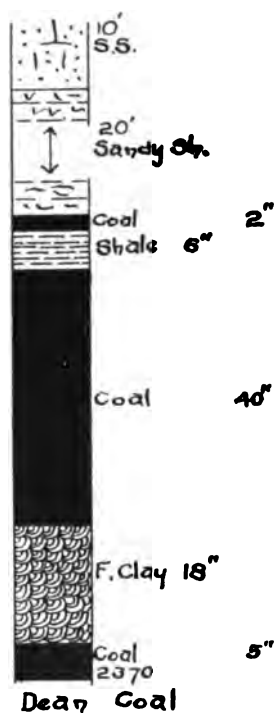
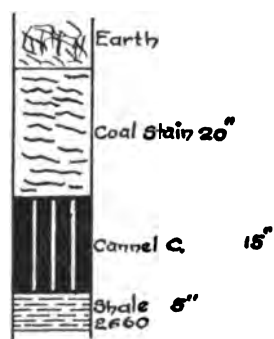


Fig 22



Head Jones Cr.

At $3\frac{1}{4}$ miles up, on the right a half mile from a gap to Crummies creek, Mr. Thruston found the coal of figure 21, poorly opened and hard to measure, with ash of the cannel estimated at 15 to 20 per cent. It was supposed to be about 100 feet below the conglomerate (the upper cliff of the Upper Conglomerate) and is therefore likely to be of what is here called the Cornett bed.

At $3\frac{1}{2}$ miles up, under a cliff in a drain on the right the Dean coal is exposed as shown in figure 22. As on Kitt's branch it is here of workable thickness, but too difficult of access to be attractive.

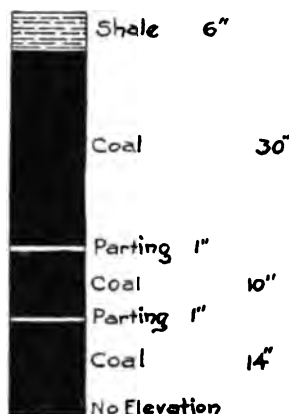
On the right of Clover fork, $\frac{1}{8}$ mile above Jones creek the Harlan coal is opened as in figure 23, its elevation not taken.

On the left of Cloverfork, $\frac{1}{4}$ mile above Jones creek, Samuel (or George Middleton has opened the Harlan Coal,

Fig. 23

Harlan Coal
Clover Fork.

Fig. 23a



Sam Middleton
Harlan Coal

as in figure 23a, the section being given by the U. S. Geological Survey.

MIDDLETON BRANCH.

On the left $7\frac{1}{4}$ miles up Clover fork, elevation of mouth 1240.

On the right $\frac{1}{4}$ mile up the branch and 230 feet above his house J. H. Middleton's entry gave the section of figure 24. The measurement was taken far enough in to indicate continuity of the partings.

YOKUM CREEK.

On the right, $8\frac{1}{2}$ miles up Clover fork, elevation of mouth, 1255.

At water level under the cliff at the mouth of the creek is 20 inches coal, also visible by the road opposite the mouth of Jones creek, in evidence elsewhere, but not known to be any thicker. It lies here 100 feet above the Harlan coal, once mined above it, but long since abandoned.

On the left of Yokum, in a drain $\frac{1}{2}$ mile up, a 2-yard entry was made into the Harlan coal, 70 feet above the creek, where the following section obtains:

Ft.	
10	Sandstone.
1	Coal.
5	Sandstone.
5	Shale.
	Coal.....15 In.
	Shale.....12"
	Coal.....3 In.
	Sandy shale....16"
	Coal.....15 In.
10	Sandstone.
	Thin coal.

Fig. 24

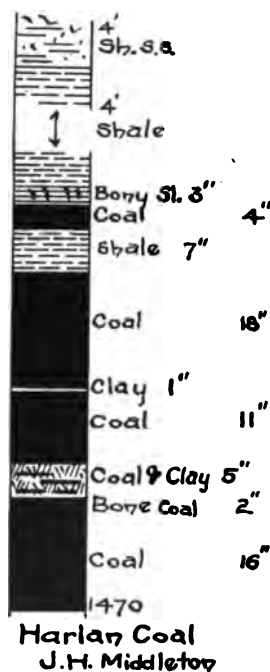
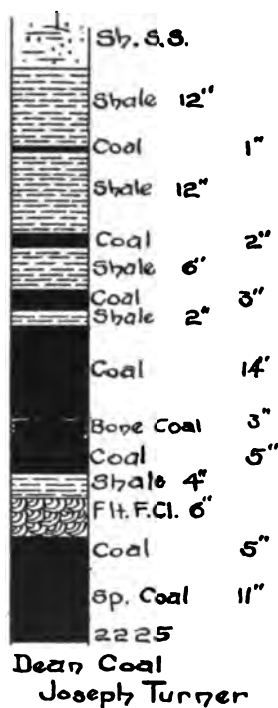


Fig. 25



The coal on the lower sandstone was partly covered. It may be $2\frac{1}{2}$ feet thick but is probably less.

On the right, $1\frac{1}{2}$ miles up Yokum the Dean coal is opened as shown in figure 25, under a long cliff on the Joseph Turner land. (Formerly Silas W. Kelly.) Its elevation was taken when a heavy thunder storm was imminent and is therefore questionable.

Gilbert Branch. On the right, $1\frac{5}{8}$ miles up Yokum, elevation of mouth, 1330.

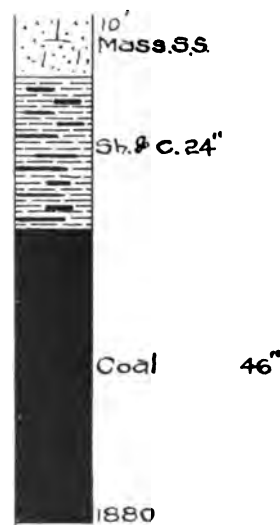
George Gilbert has, on this branch, a 7-yard entry into the Low Splint coal, with section as shown in figure 26. Though of good thickness toward the head of

Clover fork and on the south side of Little Black mountain the bed is not known to be workable, on the lower half of Clover fork.

Pounding Mill Branch. On the left, $1\frac{3}{4}$ miles up Yokum; elevation of mouth, 1335.

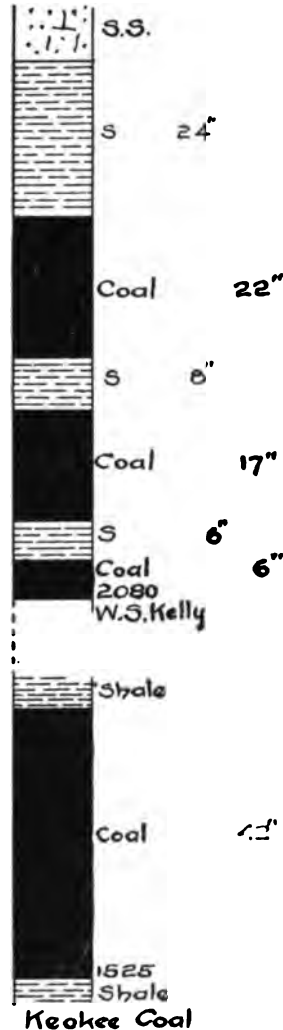
On the left of the branch, $\frac{1}{4}$ mile up it, are two seams of coal at elevation 1,385, each 9 inches thick, with 5 feet of shale between and on top of them. These are probably of the Harlan bed, and possibly give

Fig. 26



Low Splint Coal
Geo. Gilbert.

Fig. 27



Pounding Mill Br.

its full thickness at that point, but heavy covering prevented search for more of the bed below.

On the right, $\frac{5}{8}$ mile up, is the bottom coal of figure 27, here correlated as the Keokee, but possibly of the Leonard bed. The opening had fallen in so that it could not be measured accurately. At the branch, $\frac{3}{4}$ mile up it, the following section was obtained.

Ft.	
5	Shale.
1	Shale and sandstone.
	Coal..... 6 in.
	Shale..... 10 in.
	Coal..... 32 in. $\frac{1}{4}$

Elevation 1590.

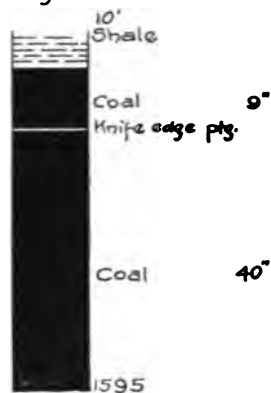
The bottom coal was in the branch, so it could not be measured accurately, and it is even possible that it may be as much as a foot thicker. If the bed of figure 27 is the Leonard this is the Keokee.

Farther up the branch, on Silas Woodson Kelly land, Mr. Threster found what is probably the Dean coal with the section of the upper coal of figure 27. He gives the coal as 825 feet above Yokum and 725 feet above Mr. Woodson's house. The latter is supposed to have been 100 feet above the mouth of Yokum, making the coal elevation 2080, as given in the figure. If 825 feet above the mouth of Pounding Mill branch it makes the coal elevation 1160, which seems to correspond more

nearly with the Turner coal across the creek, but not with that on Franks creek.

He sampled the 22 and 27" seams of the bed, which yielded on analysis by Dr. R. Peter:

Fig 28.



Keokee Coal

Frank's Creek

DEAN (?) COAL. No. 2680	
Moisture.....	1.60
Volatile combustible matter.....	37.70
Fixed carbon.....	54.84
Ash (light brown).....	5.86
Sulphur.....	100.00
Coke.....	.958
	Light spongy.

"Apparently a pretty good, firm splint coal, not much fibrous coal between the laminae, and no apparent pyrites."

Franks Creek. On the right 2 miles up Yokum; elevation of mouth, 1345.

At water level, $\frac{3}{4}$ mile up this creek, the Keokee coal gives the section of figure 28. The upper 4 inches of the 40-inch seam is hard and splinty, a feature characteristic of the coal almost everywhere present when of such thickness, but generally without the knife edge parting. Analyses of the coal by McCreath and D'Invilliers, and by Dr. R. Peter, the latter from a sample collected by Mr. Thruston, gave the following results:

KEOKEE COAL.	McC.	No. 2707
Moisture.....	1.598	1.44
Volatile combustible matter.....	38.457	33.56
Fixed carbon.....	57.339	62.80
Ash.....	1.934	2.20
		100.00
Sulphur.....	.671	.849
		99.999
Color of ash.....	Brown	Light brown gray
Coke.....		Dense.

No. 2707. "Some fibrous coal, but no pyrites apparent. A somewhat weathered sample."

A test for coke of this outcrop coal was made at the mouth of the creek in a small brick oven. By 1898 the oven had nearly disappeared, but fragments of the coke remained, which were of excellent quality, physically, being hard, bright, open texture and with metallic ring. More pieces showed imperfect burning.

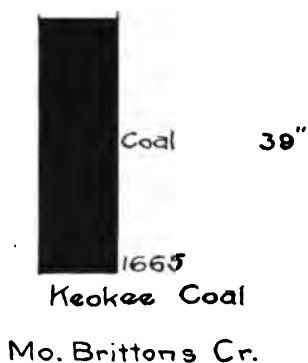
Mr. Thruston found fourteen coals above the Keokee, but all of them were thin. The U. S. Geological Survey gives the following, on Franks creek, as probably of the Dean (Creech) bed:

In.	
10	Shaly sandstone.
10	Sandy shale.
	Cannel shale..... 3 in.
	Coal..... 24 in.
	Dark drab shale..... 7 in.
	Coal..... 1½ in.
	Clay..... 2 in.
	Coal..... 4 in. Elevation 2045

The color of the shale parting corresponds with that of the flint fire-clay of the Dean coal, and the height of the coal would answer for it, but a change of the parting from clay to shale is unusual. and the bed, of some importance in this vicinity, should be looked for again, perhaps a little higher.

The top of the Harlan coal probably goes under Yokum creek about 3 miles up it. An approach to its characteristic topography can be seen in the little ends of spurs at

Fig. 29



the mouth of Pounding Mill branch and along the first mile above.

Brittons Creek. On the right, $3\frac{1}{2}$ miles up Yokum; elevation of mouth, 1,435.

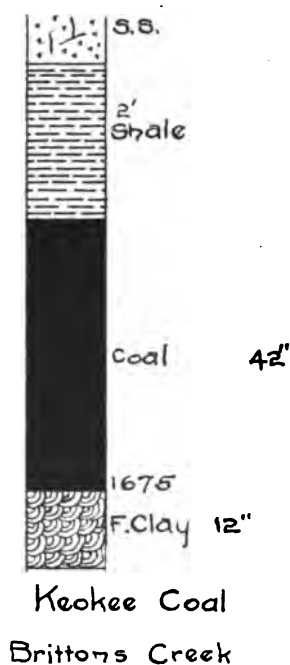
Figure 29 shows the Keokee coal as opened at the mouth of the creek in an entry said to be about 70 yards long, and having an average thickness of coal of $3\frac{1}{2}$ feet. The measurement was taken 12 yards in, as far as water would permit access.

The Keokee bed is partly opened again a half mile up the Right fork, and a mile from Yokum, showing, at elevation 1,720, $3\frac{1}{2}$ feet of coal, some of which is splint.

A coal 100 feet lower, $1\frac{1}{2}$ feet thick, shows $\frac{1}{4}$ mile up the same fork, at elevation 1,620.

On the left fork, $\frac{3}{8}$ mile up it the following section was obtained:

Fig. 30



	In.	
Black Slate.....	9"	
Coal.....	26	
Fire-clay.....	9"	
Coal.....	2	Elevation 1700.
1' Fire-clay.		
Sandstone.		

A half mile up the fork the coal of figure 30 lies at stream level. This also is in part splint coal, and, as on Pounding Mill branch, it may be of the Leonard bed, but the appearance of the coal as well as its thickness are more like Keokee.

Sharps Branch. On the right, $3\frac{3}{4}$ miles up Yokum; elevation of mouth, 1,455.

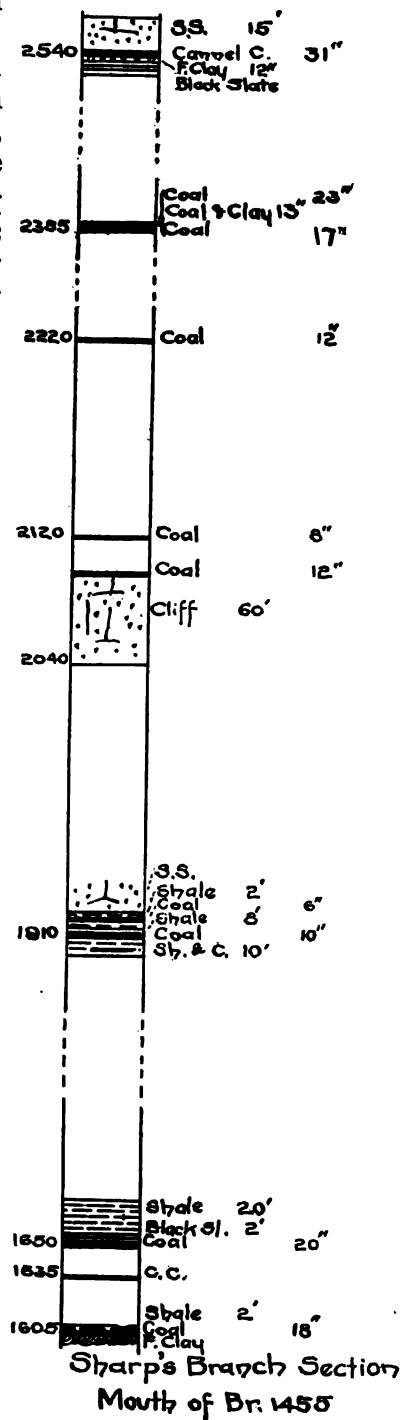
The section of figure 31 was taken along the branch up the Left fork and its branch, Horse hollow, towards the top of Little Black mountain, a total distance of $1\frac{1}{2}$ miles or more. Strata probably rise slightly in this direction so that intervals between beds may be somewhat exaggerated.

Apparently the cannel coal at elevation 1635 is of the Keokee bed, though it may be of the Leonard, with the Keokee in better condition above it. Mr. Thruston found, in 1885, 25 inches of coal, overlain by 15 inches of cannel coal shale at elevation 1650. Samples of these were analyzed by Dr. R. Peter with the results given below:

	C. 25 in. No. 2682	C. C. Sh. 15 in. No. 2681
Moisture	1.50	1.04
Vol. comb. matter	35.30	21.88
Fixed carbon	60.24	29.60
Ash	2.96	47.48
	100.00	100.00
Sulphur	1.041	5.436
Color of ash	Brown. Dense	Purplish brown. Pulveru- lent.
Coke	Spongy	

No. 2682. "A bright, pitch-black coal, breaking generally irregularly cuboidal. Very little fibrous coal and no pyrites apparent in the sample."

Fig. 31

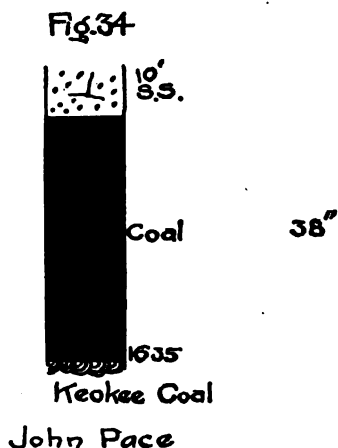


Turner Creek. On the left, $5\frac{1}{2}$ miles up Yokum; elevation of mouth, 1575.

In the section of figure 33, the bottom coal, probably of the Leonard bed, was opened in the point of the hill at the mouth of Turner creek, where its full thickness may not have been obtained.

The other thin coals up to the Dean, show in the bed of the creek a half mile east of the Samuel Middleton house.

The Dean coal is exposed in a large rock-house in Grave-yard hollow, a quarter mile west of the same house.



At John Pace's store, $5\frac{5}{8}$ miles up Yokum, and on the right of the creek, 5 feet above it, the Leonard (?) coal is 28 inches thick, under a foot of black slate, at elevation 1605.

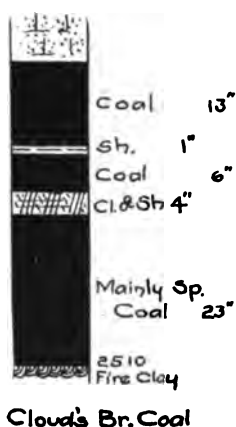
Across the creek the Keokee (?) bed has been opened as in figure 34. It is to be noted that while the upper of two contiguous beds is here considered the Keokee, farther down Yokum it is the lower of two. Warrant for this lies in the fact that there are beds (as found above Seagrave creek and elsewhere) close under and above the Keokee.

White Oak Branch. On the right, 6 miles up Yokum; elevation of mouth, 1625.

On the right a half mile up White Oak is Cloud's branch, and in the left hollow from Cloud's house the section of figure 35 was obtained. The coal at the bottom is about on the level of the Dean, but without the flint clay parting the correlation is uncertain.

The coal at elevation 2510, reproduced in the lower coal of figure 36, is not recognized elsewhere in the region in this vicinity as a workable coal, though it appears to be of some importance Martin's fork.

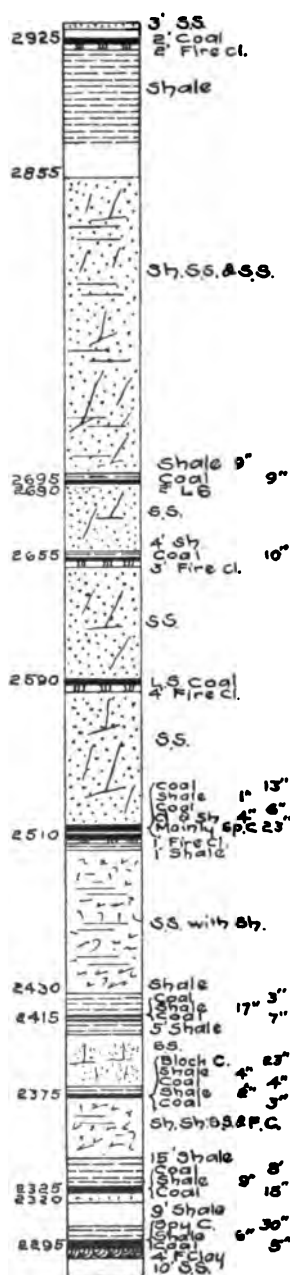
Fig. 36



The limestone coal at elevation 2590 in the two figures, with its total bed thickness of nearly 14 feet, should be of much value if constant, but its great variability and height are much against it. It is one of those beds without appreciable value now, in this vicinity, to be worked in the distant future.

The upper coal of the section was not opened to determine its thickness. It is perhaps, of the Cornett or High Splint beds, but too near the top of the mountain for satisfactory area.

Fig. 35



Section on Cloud's Br.

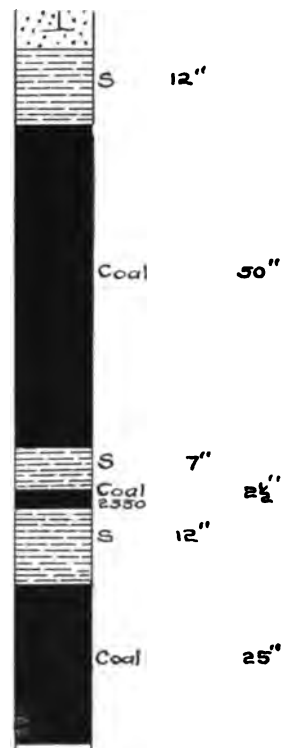
Fig. 36a



Clouds Br. Coal

Mr. Thruston found on the Calvin Pace land the coal of figure 37, which seems to correspond with the upper part of the limestone coal of figure 36, with its upper partings missing. According to its elevation it lies about midway between the two coals of the latter figure, but having been found at a different time, so much discrepancy may readily be referred to the barometer.

Fig. 37

L.S. Coal (?)
Calvin Pace

The sections, figures 38 and 39 show my interpretation of the results of Mr. Thruston, and my investigations at different times, separately and together, in different hollows of the main head of Yokum.

The Dean coal at the bottom of the sections is fairly well established, although the clay parting in it did not show as flint clay. Also on Wright Winn's land, Mr. Thruston found this coal and sampled it. Its bed-section

Fig.38

R.C.B.T.

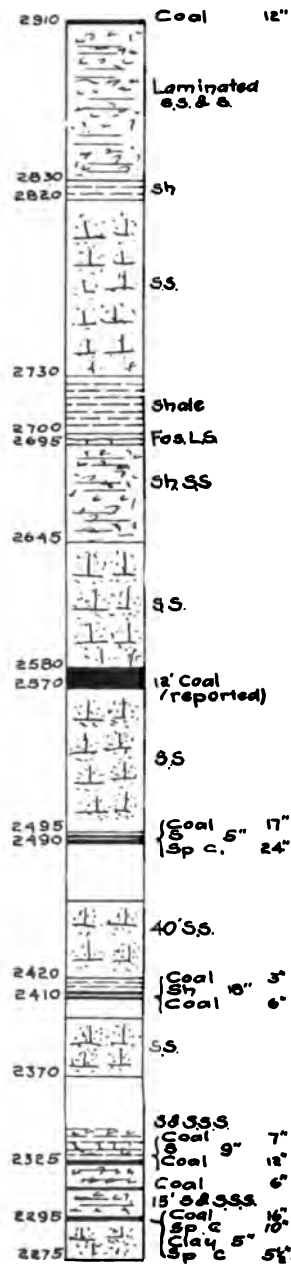
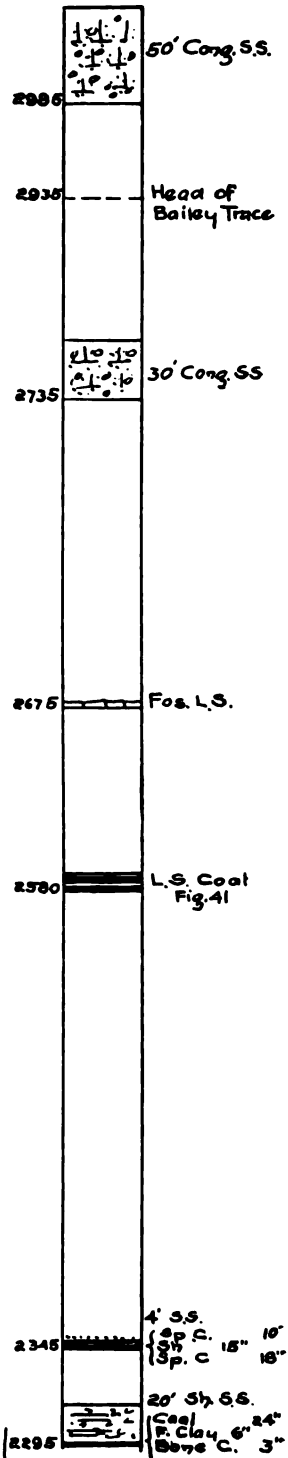


Fig.39

J.M.H.



Head of Yocum Creek.

there and results of analysis of the $31\frac{1}{2}$ inches coal, by Dr. R. Peter, are given below:

	In.	DEAN COAL No. 2683.	
Shale.....		Moisture.....	1.52
Splint Coal.....	16	Volatile com. matter.....	33.00
Coal.....	10	Fixed carbon.....	51.96
Clay.....	5	Ash (light gray).....	13.52
Coal.....	5 $\frac{1}{2}$		
			100.00
		Sulphur.....	0.684
		Coke	Dense spongy.

No. 2683. "Portions breaking somewhat irregularly; pitch-black with shining surfaces. Other portions dull black, breaking in irregular laminae, with but little fibrous coal between them, and no apparent pyrites."

The Limestone coal bed, (see figure 41) though of about the same thickness as on Cloud's branch, differs from it so much in section that no dependence can be placed on the bed in mining.

The fossil limestone is found here 125 feet above the Limestone coal, a considerable greater distance than is known between them elsewhere.

The coal at the top of the section in figure 38, is 225 feet above the fossil limestone, and under the conglomerate of figure 39. Though it is doubtless of the High Splint bed, being so near the top of the mountain, it evidently was not thought worth opening to full thickness.

Fig. 40

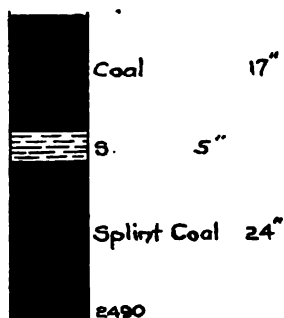


Figure 40 represents on large scale the coal found at elevation 2490, and figure 41 gives in detail the Limestone coal bed of figure 39.

Mr. Thruston also gives a section of what is probably the Limestone bed as found on the spur between White Oak branch and main Yokum. This is shown in figure 42.

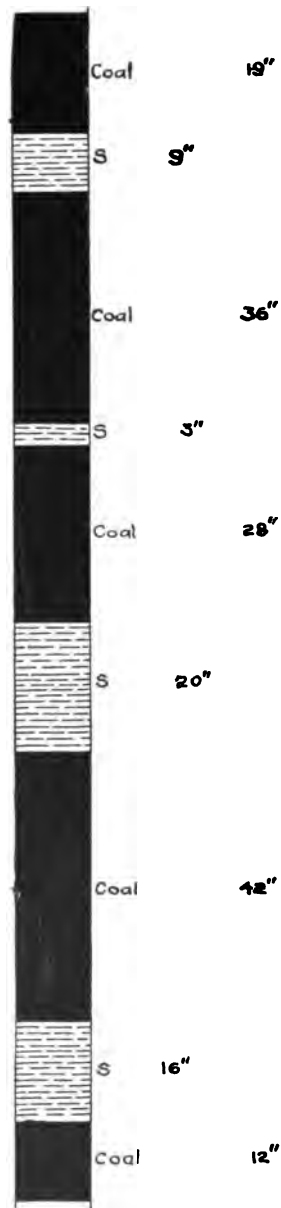
Fig. 42

Fig. 41



Limestone Coal

Head Yokum Cr.



Head of Yokum Creek

Bailey's Trace Virginia. Across the mountain from the head of Yokum creek, in the railroad cut just below the mouth of Bailey's Trace, at St. Charles, the Imboden coal has been opened with a thickness of 28 inches. A heavy sandstone lies directly below it.

The Kelly coal, or "Cooper" coal here, lies 60 to 80 feet higher and has a bed-thickness of 3 to 5 feet, but its several partings are so deleterious that attempted mining has proved unprofitable.

The Harlan coal has been opened in a 20-yard entry in a left branch, some 30 feet above Bailey Trace, where it has $3\frac{1}{2}$ feet of good clean coal. The correlation of this bed through to Clover fork should lead to its further development here. Its elevation, according to the system brought over from Clover fork is 1525. According to levels in use at St. Charles, said to be sea-levels, its elevation is about 1800; the barometric readings having been well checked, the difference remains unaccounted for.

The Keokee coal lies at elevation 1725 where it goes under Bailey Trace. (It is called here the No. 5, or Darby, coal and its elevation is given as 2000.) What promised when last visited to be the principal mines of the creek were being developed on Fawn branch, where the coal was reported to run about $3\frac{1}{2}$ feet thick.

The Low Splint coal, or one seam of it separated from the other by a heavy parting, shows thin 210 feet above the Keokee.

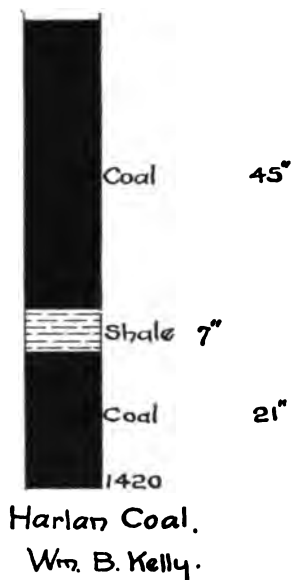
The Dean coal, 470 feet higher, at elevation 2405, has about 45 inches of nearly clean coal.

The bed below the Limestone coal is opened in a 10-yard entry at elevation 2575 with one clay parting of 9 inches, and two others of 1 inch and knife-edge thickness. This bed might well be mined at an early date, if, as it appears, it will make good coke. It has but very little splint coal in it.

BAILEY CREEK.

On the left, 9 miles up Clover fork; elevation of mouth, 1265.

Fig. 43



A quarter mile up the creek and $\frac{1}{4}$ mile up a left branch is W. B. Kelly's new entry, having the section given in figure 43, the coal apparently of good quality and showing no indication of altering bed-section. But an old entry beside it, now fallen in, gave the following measurements:

Ft.	In.
	Sandstone.
5	Sandy shale.
	Coal.....11
	Coal and Shale.....4"
	Cannel coal (1 in. bone).....15
	Shale.....1"
	Shale (with c).....10"
	Coal.....18 El. 1420

This is almost the only known occurrence in this region of cannel coal in the Harlan bed.

On the left, $\frac{1}{2}$ mile up Bailey creek, 100 feet above it, the Harlan bed was opened with the following approximate section:

Ft.	
10	Sandstone.
$3\frac{1}{2}$	Coal and small partings.
1	Shale.
$1\frac{1}{2}$	Coal.

The bottom coal was covered with water when visited and the remainder was beyond reach.

Left Fork. One mile up Bailey creek.

In the section, figure 45, the Harlan coal shown at the bottom is opened $\frac{1}{8}$ mile up the Left fork and 20 feet above it. From this point the section is carried up the Left fork to its upper forks, thence again up the Left fork and its second branch. Figure 44 shows coals found on the left, $\frac{1}{8}$ mile above the Harlan coal of figure 45.

The horizontal distance between the upper and lower coals of that figure is perhaps a mile, giving room for a considerable rise or fall of strata, but they appear to run very nearly level.

The Harlan coal of Figure 45 is shown on enlarged scale in figure 46. The entry 40 yards or more long, formerly known as the Wright Kelly and later as the Dixon mine, is now abandoned and a new one started beside it, from which the measures in the figure were taken 4 yards in.

The old entry has a variable section not differing greatly from the figure, unless near its head. A private report gives the section:

Coal (with two knife edge partings).....	41"
Parting.....	23"
Coal.....	13"

supposed to have been taken near the head of the entry.

The U. S. Geological Survey reports two analyses, given below, from samples taken by Prof. A. S. McCreath, one of the bottom seam and one of all the coal above it. To these is added one from the private report just referred to, presumably including all of the coal, and two from the same source of its coke. The high ash given in the second column is not representative of the coal.

HARLAN COAL.	Bottom Seam.	Above Bottom.	All the Coal.	Coke.	
Moisture.....	1.376	1.470	.....	2.55	2.55
Volatile combustible matter.....	37.504	33.510	38.50	2.80	3.52
Fixed carbon.....	52.660	48.880	54.90	88.80	84.19
Ash.....	7.470	14.910	6.60	8.40	9.07
			100.00	100.00	99.33
Sulphur.....	.990	1.230	1.073	.619	.67
Phosphorus.....	.....	.....	.030	.024	.037
	100.000	100.000			

The Leonard coal is shown, thin in figure 45, under the Keokee coal at elevation 1635, which is enlarged in figure 47. The mixed shale and coal lying on the main seam of coal of this bed is a common occurrence on Clover fork. At the head of the fork it becomes all coal.

The Low Splint bed at elevation 1850, is exposed in a rockhouse on the left a mile up the Left fork.

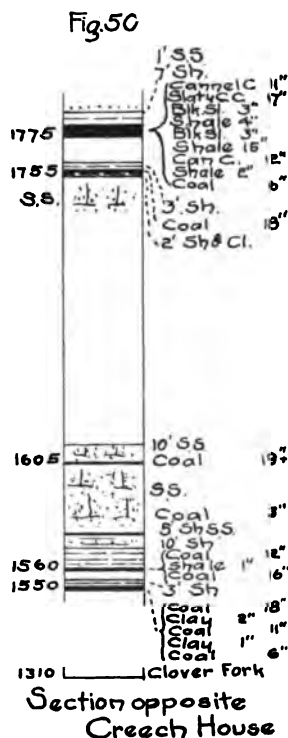
An unopened splint coal at a lick on a prominent bench of the upper Left fork, elevation 2200, is probably of the Dean bed, or near to it.

The coal at the top of figure 44 is evidently the same as the cannel bed found on Yokum creek, 185 feet above the Dean coal, and as there, it is without cannel in, the next hollow.

The higher coals of figure 45 are not sufficiently developed for correlation, but the thickness of that one at elevation 2750, shown also in figure 48, is indicative of the High Splint coal, or possibly the Cornett. These upper beds were infrequently opened in this vicinity, neither side of the mountain at the heads of this creek affording favorable opportunity for prospecting.

Bailey Creek, Right Fork. On the left, a quarter mile up this fork, 15 feet above water level, is the Harlan coal of figure 49. The partings of the Left fork coal are visible here in the knife edges of clay, which appear as surface effects only.

In a rockhouse, as on the Left fork, $\frac{3}{4}$ mile up the Right fork, 20 feet above it, the Low Splint bed has the following section:



Ft.	In.
15 Sandstone.	
Coal.....	3
Shale.....	1"
Coal.....	25:29
Shale.....	2"
Coal.....	2

On Clover fork road above Bailey creek are overhanging cliffs of sandstone below the Harlan coal, and near their base the flagstone mentioned early in this report, 2 to 3 feet thick, about 70 feet below the coal, can be seen.

The section of figure 50 is combined from exposures in two drains on the right, $11\frac{7}{8}$ miles up Clover fork. Sandstone, not shown in the figure, apparently cuts out the Harlan coal completely.

The coal at 1550 is probably of the Leonard bed; that at 1560, or

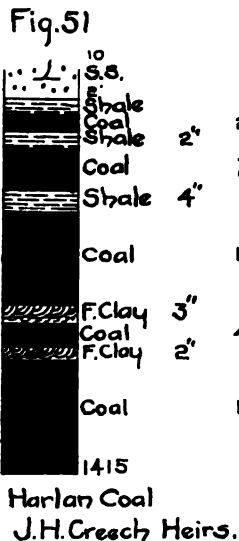
the unopened coal above it of which 19 inches was seen, is the Keokee.

The upper bed containing cannel, is, on that account, correlated with a bed below the Low Splint, found with cannel farther up Clover fork. The 11- and 12-inch seams are of good block cannel coal.

LAUREL BRANCH.

On the left, 12 miles up Clover fork: elevation of mouth, 1315.

By the branch, $\frac{1}{4}$ mile up it, the Harlan coal has been opened, as shown in figure 51, to 3 yards underground. The coal contains, rather more splint than is found farther down Clover fork, and the 7-inch seam carries 2 inches of cannel coal. The following analyses of this coal, with section given practically the same as in the figure, and of its coke, yielded by private analysis:



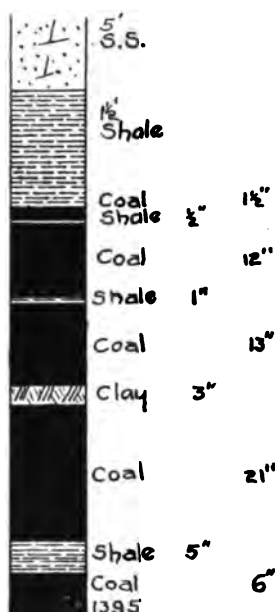
HARLAN COAL.	Coal	Coke	Coke
Moisture.....	.....	.....	.86
Volatile.....	39.10	3.80	3.44
Fixed carbon.....	55.30	86.90	83.86
Ash.....	5.60	9.30	11.01
	100.00	100.00	99.17
Sulphur.....	.949	.715	.83
Phosphorus.....	.011	.008	.012

LIGE BRANCH.

On the right, $12\frac{1}{4}$ miles up Clover fork; elevation of mouth, 1320.

The Jefferson King entry, $\frac{1}{2}$ mile up this branch, 10 yards in in 1899, gave the section of figure 52. The coal lies on 10 feet of sandstone, under which is about a foot of coal. The following analyses of this coal and its coke are reported, with but slightly varying measure of its bed-section

Fig. 52



Jefferson King
Harlan Coal.

Fig. 53



Harlan Coal
B.F. Gilbert

HARLAN COAL	Coal	Coke	Coke
Moisture.....			0.23
Volatile.....	38.50	3.90	3.28
Fixed carbon.....	54.80	86.20	83.60
Ash.....	6.70	9.90	12.00
	100.00	100.00	99.11
Sulphur.....	1.07	0.70	0.87
Phosphorus.....	.009	.008	.014

ANDREW BAILEY BRANCH.

On the left, 12 1/2 miles up Clover fork; elevation of mouth, 1,325.

At water level, 1/4 mile up this branch, the following section was taken:

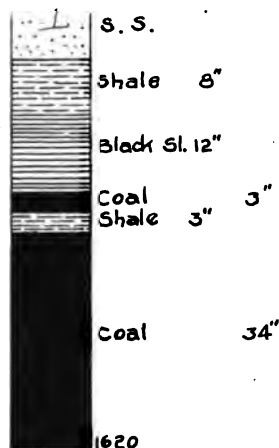
Ft.	In.
2	Shale.....
	Coal.....24
	Shale.....6"
	Black shale and coal 3"
	Shale.....3"
	Coal.....12
	Clay.....2"
	Coal.....2
1 1/2	Fire-clay.
15	Sandstone.
	Coal.....18 El. ± 1395

The bottom coal here appears to be the same as that on Lige branch next preceding, and the worthless 3 feet of coal above it the Harlan coal, but further investigation is needed here. The coal above the fire-clay, 10 yards farther up and in the branch is changed to two 18-inch seams with 3 feet of sandy shale between.

The Gilbert opening of figure 53 was made in the field above his house close to Clover Gap branch, never carried underground and soon filled in. McCreath and D'Invil-

A small pit sunk in the mountain top a half mile west of the gap, at elevation 2800 gave 2 to 3 feet of coal stain of the High Splint bed. There is doubtless more coal under the heavy sandstone cliff a few yards farther west. That the excellent showing of the bed east of Clover Gap is not continued farther west may be due to its being undeveloped there. The smaller area in the western portion, though still ample to afford a valuable deposit, did not warrant spending more of the limited time of the Survey than was required to demonstrate its presence here. It is difficult to find and hard to open, and hitherto was unknown on this end of the mountain.

Fig. 55



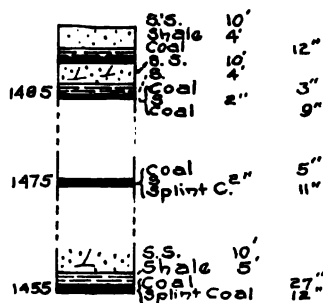
A. Z. Kelly
Keokee

KELLY BRANCH.

On the left, $13\frac{1}{4}$ miles up Clover fork, elevation of mouth, 1345.

Figure 56 gives a section on this branch, taken by Mr. Thruston, showing the Harlan coal at the bottom and small coals above it.

Fig. 56



Section on Kelly Br.

On the left, by the road, $13\frac{3}{8}$ miles up Clover fork on A. Z. Kelly's land, the Harlan bed gave:

	Inches
Coal stain	5
Shale	17"
Coal	46
Elevation 1410.	

The bottom coal was in water so its thickness is only approximate, and a parting there might have passed unnoticed.

SEAGRAVE CREEK.

On the right, $14\frac{7}{8}$ miles up Clover fork; elevation of mouth, 1385.

For a general view of the coals of this vicinity see the longitudinal section, figure 3.

The Harlan coal is opened on the right, $\frac{1}{8}$ mile up this creek with bed section of the lower coal of figure 58. Its place is shown also at the bottom of figure 57, the higher coals of which were found on Abner's fork a tributary on the right of the creek, $\frac{3}{4}$ mile up it.

With 305 feet interval in this section from the Harlan coal to the Keokee and 1200 feet from that bed to the High Splint a rise of strata in going up stream is indicated, which appears to be greater than should obtain near the synclinal axis, and an error in elevations amounting to 100 feet or more is suspected. This is more likely since the Leonard and Keokee coals are placed higher here than elsewhere in the vicinity. The sequence of coals, however, is correct.

The correlation of the Leonard and Keokee coals is determined here by their cannel slate and semi-cannel coal, festures which become prominent in the two bed on Steep Hollow branch, $\frac{3}{4}$ mile above Seagrave. The main seam of the Keokee bed, figure 58, consists of 28 inches of rich block coal underlying 8 inches of semi-cannel.

Fig. 57

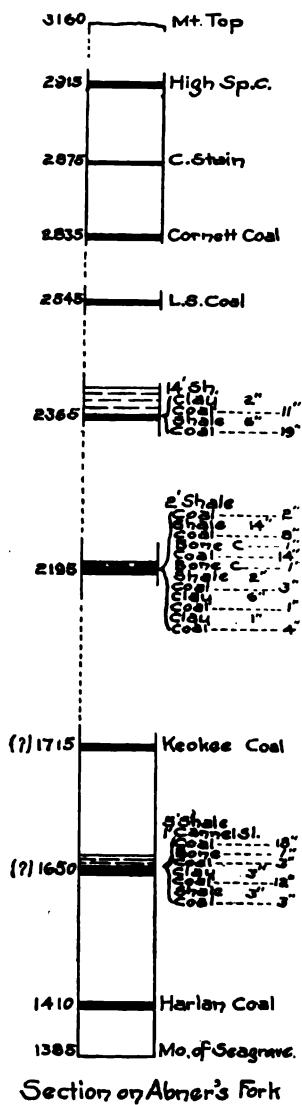
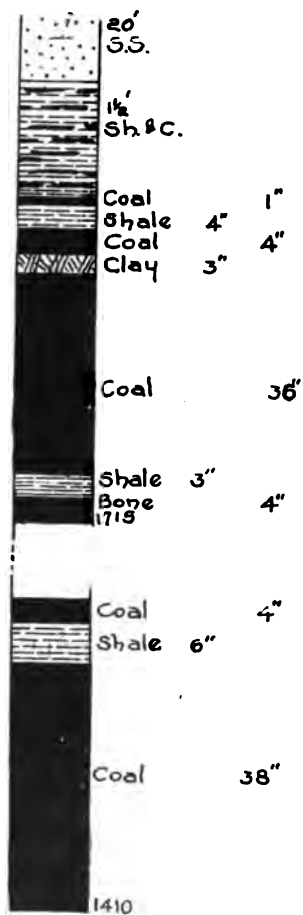
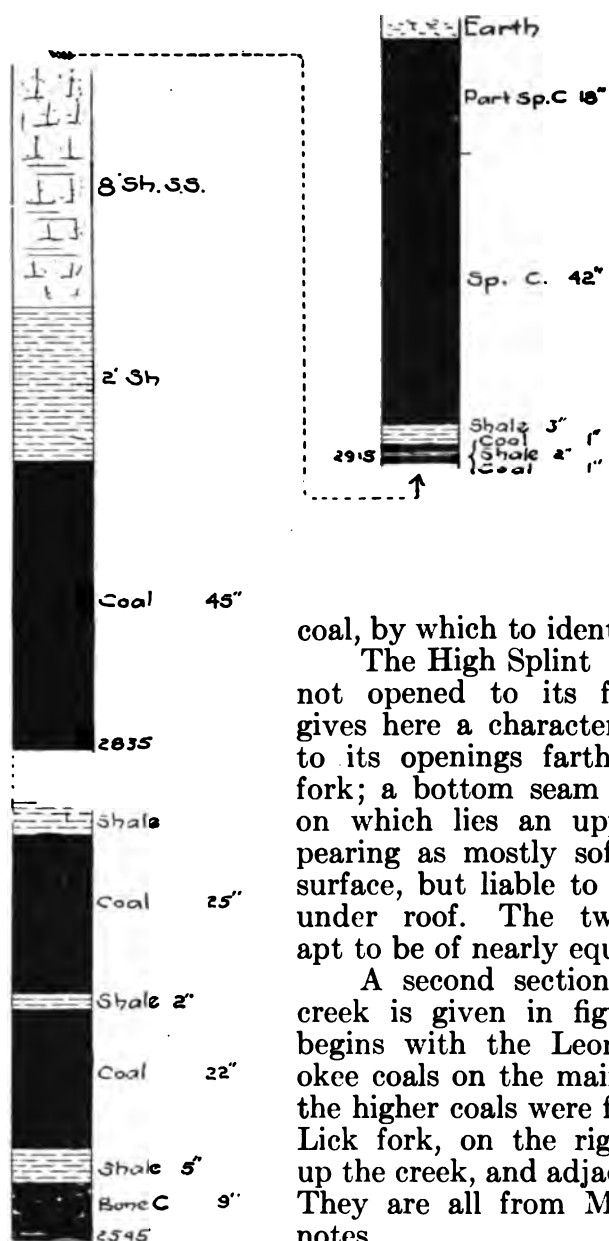


Fig. 58



Keokuk & Harlan Coals
Seagrave Creek

Fig. 59



Measuring down from the High Splint bed, it appears that the coals at elevation 2,195, 2,545 and 2,835 are of the Dean, Limestone and Cotnett, beds, respectively, but there is nothing within the beds, other than thickness of

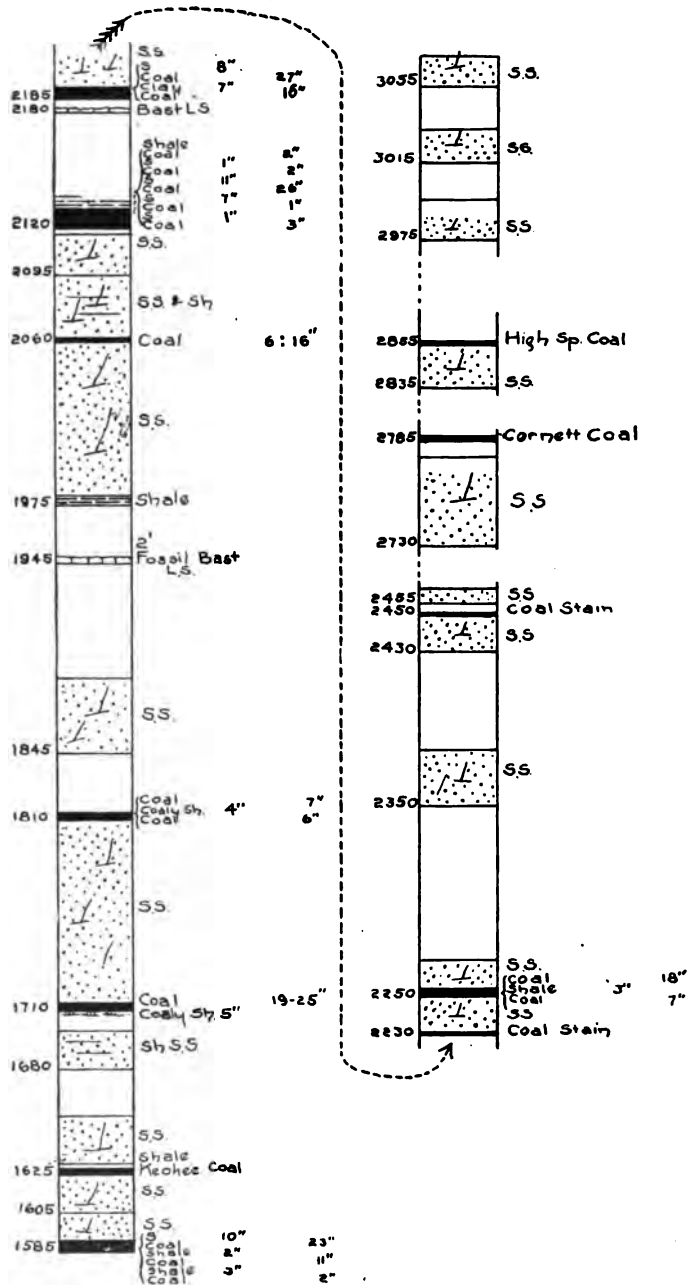
coal, by which to identify them here.

The High Splint bed, probably not opened to its full thickness, gives here a characteristic common to its openings farther up Clover fork; a bottom seam of splint coal on which lies an upper seam appearing as mostly soft coal at the surface, but liable to be splint coal under roof. The two seams are apt to be of nearly equal thickness.

A second section on Seagrave creek is given in figure 60. This begins with the Leonard and Keokee coals on the main creek, while the higher coals were found on Mud Lick fork, on the right, 1½ miles up the creek, and adjacent branches. They are all from Mr. Thruston's notes.

Seagrave Creek

Fig. 60.



Section on and near Mud Lick Fork.

The Leonard coal, at elevation 1585, was found in the Isaac Creech tract, on the right of Seagrave, $1\frac{1}{8}$ miles up it. A later measure of the bed gave a 1-inch parting in the middle of the 23-inch seam, but a sample was taken by Mr. Thruston earlier from all of the coal, as given in the figure. This was analyzed by Dr. R. Peter with the results following under No. 2685.

The Keokee coal is exposed in a cliff on the right, 15 feet above and $1\frac{1}{4}$ miles up the creek. It is shown, enlarged, in the bottom coal of figure 61. Mr. Thruston's sample of this 39 inches coal, analyzed by Dr. R. Peter, gave the results following under No. 2700.

The Dean coal, stated to be here 400 feet below the fossil limestone, is shown in the section at elevation 2185, and a second opening, in "Slip Hollow" is given at the same height in figure 61. The latter, of which the bottom coal is splint, sampled and analyzed as above, gave the results under No. 2701.

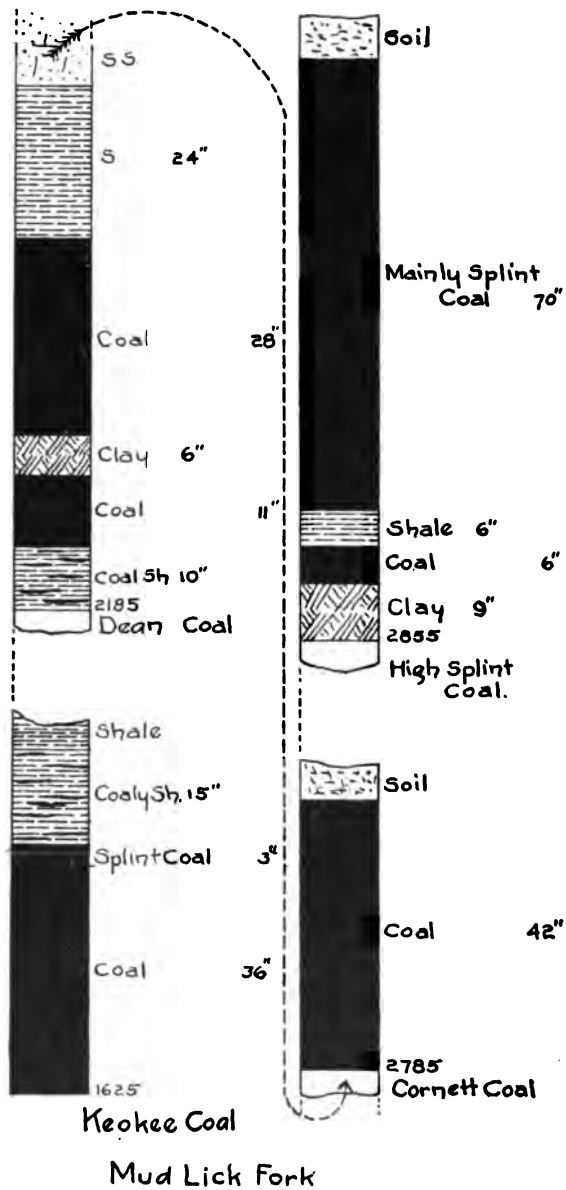
The Cornett coal is shown at elevation 2785 in both figures.

The High Splint at 2855 with its earth covering may not have been fully developed and its total thickness discovered, though giving a foot more coal than on Abner's fork. With over 200 feet of covering this rich coal should be profitable to mine here in spite of its great height. Dr. R. Peter's analysis of Mr. Thruston's sample of the 70-inch seam of this coal follows, under No. 2697.

	LEONARD No. 2685	KEOKEE No. 2700	DEAN No. 2701	HIGH SPLINT. No. 2697
Moisture.....	1.58	1.52	4.64	3.10
Volatile combustible matter....	31.82	34.88	29.16	36.10
Fixed carbon.....	63.20	60.70	55.20	56.60
Ash.....	3.40	2.90	11.00	4.20
Sulphur.....	100.00	100.00	100.00	100.00
Color of ash.....	1.288 Brown.	.615 Brownish- gray.	.986 Very light brownish- gray.	.794 Light brownish- gray. Dense.
Coke.....	Spongy.	Dense spongy	Pulverulent	

No. 2685. "A pitch-black coal, breaking generally into irregular laminae with shining surfaces. Some pieces more dull. Some bright scales of pyrites and fibrous coal apparent."

Fig. 61



No. 2700. "The sample contains some splint coal, but is mostly coal which breaks irregularly cuboidal, with shining, irregular surfaces, having little or no pyrites or fibrous coal."

No. 2701. "A badly weathered sample, showing some fibrous coal but no pyrites."

No. 2697. "Mostly splint coal badly weathered, with some clay intermixed."

Combining the coals of the two sections the following list of coals is obtained, which includes all the principal coals excepting the Low Splint. The smaller beds found with 2 feet or more of coal are interpolated, but, doubtless, other beds of equal thickness remain to be discovered. The thickness of coal in each is given with small seams left out which would be neglected in mining, and where two openings were made in the same bed the average thickness is given.

	In.
High Splint Bed.....	68
Cornett Bed.....	43½
Limestone Bed.....	47
.....	30
Dean Bed.....	31
.....	26
Keokee Bed.....	37½
Leonard Bed.....	34
Total.....	317=26 5-12 feet.

Of beds with over 3 feet of coal the total amounts to 161½ feet.

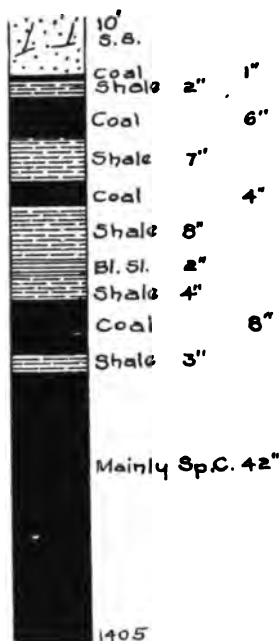
BIG ROCK BRANCH.

On the right, 15¼ miles up Clover fork; elevation of mouth, 1395.

The Harlan coal is exposed under a fall in the branch, but 10 feet above Clover fork. Its section is shown in figure 62.

In the field on the left, opposite and just above Big Rock branch, the Harlan coal has been opened to roof with the thickness given in figure 63. This is its last opening before going under Clover fork.

Fig. 62



Harlan Coal.
Big Rock Br.

An opening on the Brewer land into what is regarded as of the Low Splint bed was reported as having this section:

	Inches
Coal.....	15
Parting.....	1"
Coal.....	20
Parting.....	4"
Coal.....	6

Its location on the left of Clover fork, was not further described.

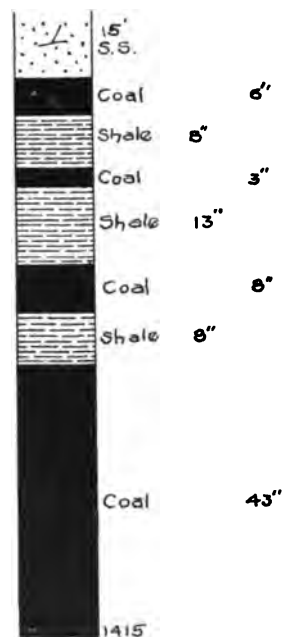
Again, on the Winn land, on the left of Clover fork, what is believed to be the Keokee bed, was reported with the following:

	Inches.
Coal.....	15
Parting.....	9"
Coal.....	4
Parting.....	7"
Coal.....	37

Of two openings in Winn's field, nearly opposite Steep Hollow branch, the under one, of the Leonard bed, gave the following:

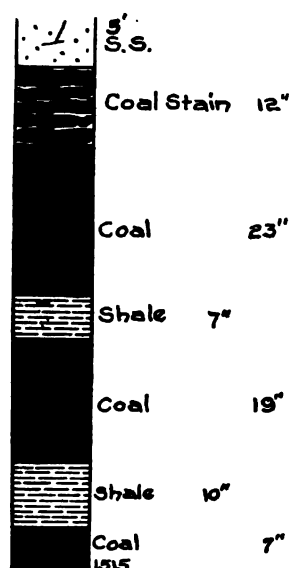
	Inches.
Slaty cannel coal.....	12
Cannel slate.....	9"
Parting.....	28"
Cannel coal.....	18
Elevation, 1500.	

Fig. 63



Harlan Coal
Opp. Big Rock Br.

Fig. 64



Keokee Coal
Above Big Rock Br.

The upper one gave the section of figure 64.

Another opening into the Leonard (?) bed in the close vicinity is reported with two seams of cannel coal of 34 and 15 inches, respectively, the latter on top, and a parting of 14 inches.

STEEP HOLLOW BRANCH.

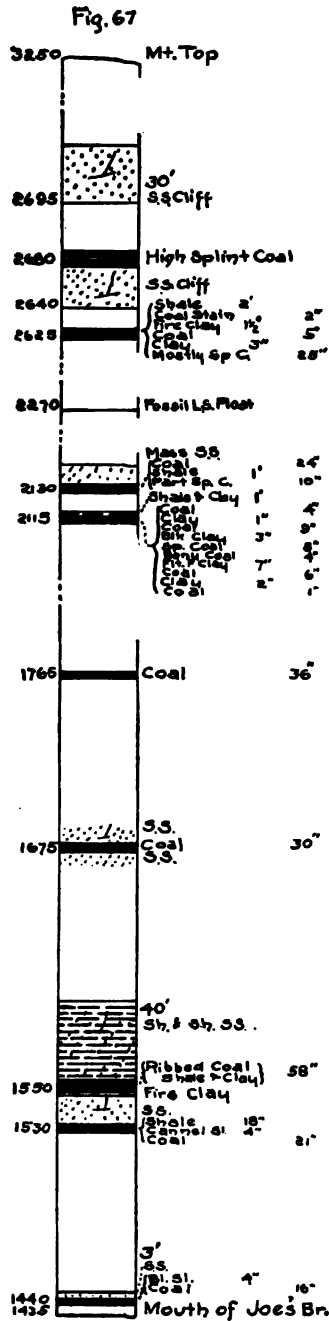
On the right, $15\frac{5}{8}$ miles up Clover fork; elevation of mouth, 1410.

The section of figure 65 is chiefly remarkable for the alternations in it of coal and parting.

The Leonard coal, at elevation 1480 is reproduced in the bottom of figure 66, with slightly different measure.

That of figure 65 was by Mr. Thruston, who sampled the 31 inches in the three lower seams of coal, from which Dr. Peter's analysis gave the results following under No. 2870.

The Keokee coal at elevation 1520 in the two figures has given various measures here to different observers at different times, because of varying section along the outcrop opened, and of differing opinions as to what was coal and what was cannel slate. The section given is from my latest measure and is fairly representative. The bed was opened in and by the branch, and its coal is known as the John M. Smith cannel, named after a former owner. Dr. R. Peter's analysis of Mr. Thruston's sample of 37 inches cannel follows under No. 2703, and McCreath and D'Invillier's analysis is given in the last column. Their measurement of the cannel was $36\frac{1}{2}$ inches including a knife edge parting.



Joe's Branch Section

	Leonard No. 2870	Keokee No. 2703	Keokee McC.
Moisture.....	3.60	1.56	1.394
Vol. com. matter.	29.40	42.64	49.261
Fixed carbon.....	57.00	46.48	39.480
Ash.....	10.00	9.32	9.000
Sulphur.....	100.00 .622	100.00 0.574	.865
Color of ash.....	Light gray.	Grayish- brown.	100.000 Brown.
Coke.....	Pulverul- ent.	Dense.	

No. 2870. "Sample much crumbled and somewhat weathered."

The Low Splint coal appears to be represented by the thin coal at 1750 or 1760, though it may be under the sandstone at 1835. This would conform more nearly with its usual distance from the unopened Dean coal at 2145.

JOE'S BRANCH.

On the left, 16 $\frac{3}{8}$ miles up Clover fork; elevation of mouth, 1435.

The bottom coal of figure 67 is exposed at water level a few yards above and below Joe's branch. It is of interest because of its black slate by which it can often be identified, thereby helping to locate approximately the Keokee bed about 100 feet above it. Here, however, it is of little avail owing to a quite rapid local dip northwest.

Mr. Thruston gives the Keokee coal as shown at elevation 1530, but it is possible that he reached only the top coal of the bed. A thick parting separates this from the main coal on Steep Hollow branch. All signs of his opening have long since disappeared.

The coal opened at elevation 1550, on the right, $\frac{1}{8}$ mile up, is 40 feet above the Keokee in Steep Hollow.

The Low Splint bed at elevation 1765, with opening fallen in when visited, is reliably reported 36 inches of coal without parting.

The Dean coal, opened on the left at elevation 2115, has here its flint clay parting, part the usual brown and part black as coal but heavier and with different fracture.

The fossil limestone was found 40 feet or more below the cliff from which it was supposed to have come.

The coal at elevation at 2625, is about where the Cornett should be, and the cliffs about there seem to give room for it in no other place, but more search is needed to verify the bed.

The High Splint coal was opened as shown in figure 68, at elevation 2680, nearly above the preceding, on the left of the Left fork, about $\frac{1}{4}$ mile from the junction of the forks. It gives here its maximum thickness so far found, and creates a suspicion that the Cornett has united with it. Its height of 1200 feet above the Keokee shows that the reverse dip at the mouth of the branch is of small extent, the actual interval between the two beds here being somewhere about 1100 feet.

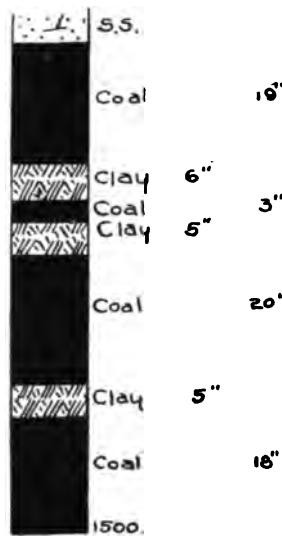
On the left of road and stream $16\frac{1}{2}$ miles up Clover fork, 60 feet

Fig. 68



High Splint Coal
Joe's Branch

Fig. 69



Leonard Coal
Above Joe's Br.

above it, the Leonard bed is opened in a 6-yard entry to the section shown in figure 69. The upper and lower partings are quite variable, one reaching, at one point in the entry, a thickness of 10 inches.

The Keokee bed was partly opened in the point of the hill above the entry. The section obtained here was:

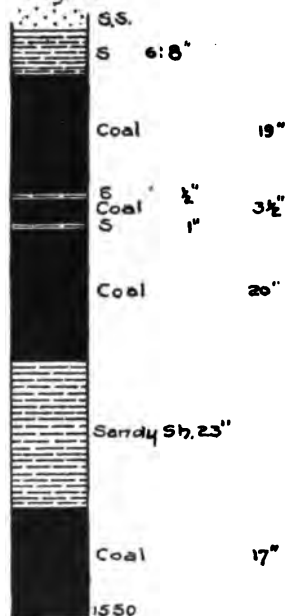
Shaly sandstone.
1½' Shale containing cannel slate.
Coal stain (partly splint)..... 19" El. 1565

JESSE BAILEY BRANCH.

On the right, 17½ miles up Clover fork; elevation of mouth, 1455.

Mr. Thruston gives as on this this 1 branch, the coal of figure 70 which is referred to the Leonard bed on account of its resemblance to the section of figure 69.

Fig. 70



Leonard Coal
Bailey Branch

Fig. 75
Sketch Map of Fugitt Creek

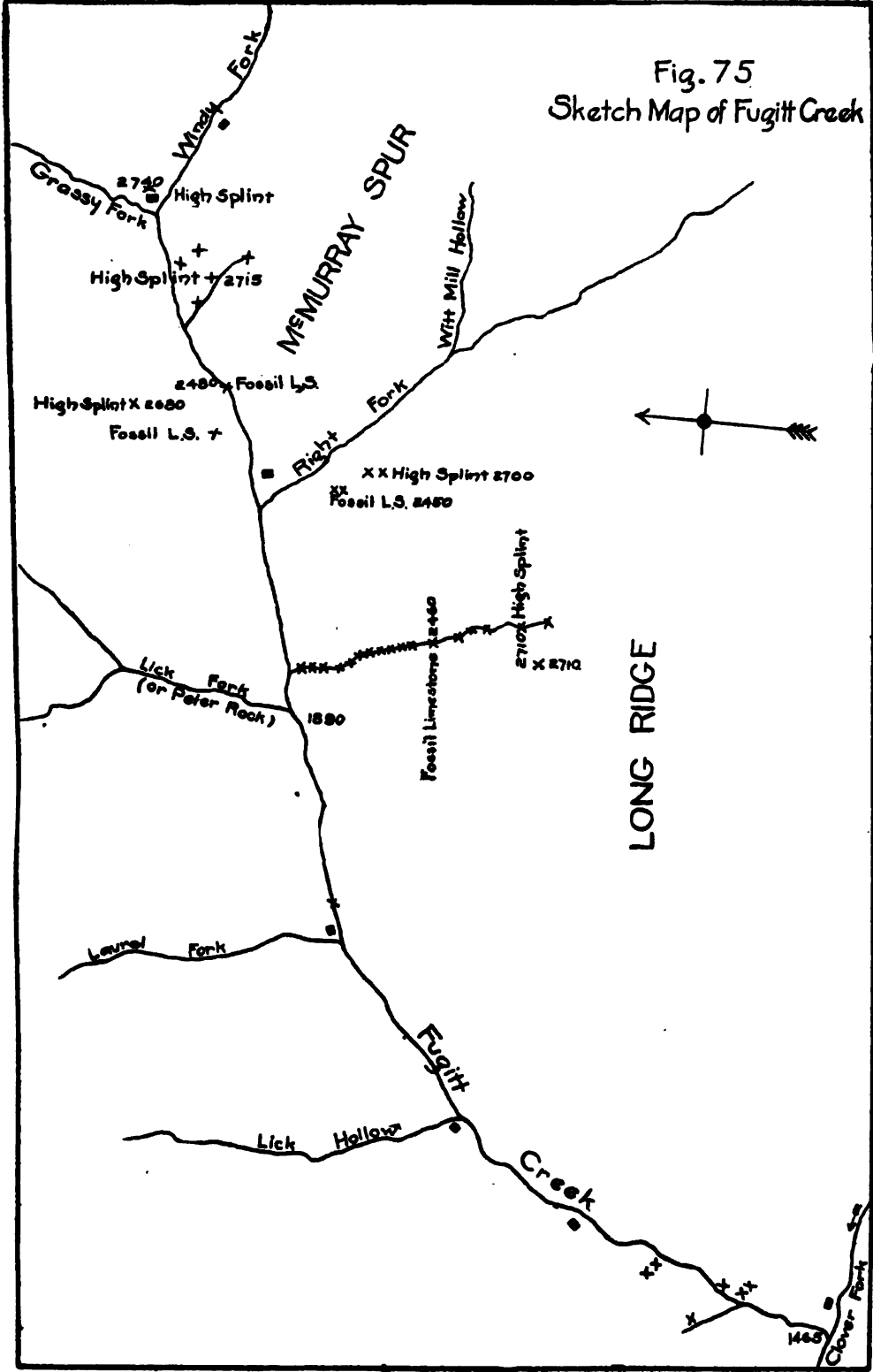
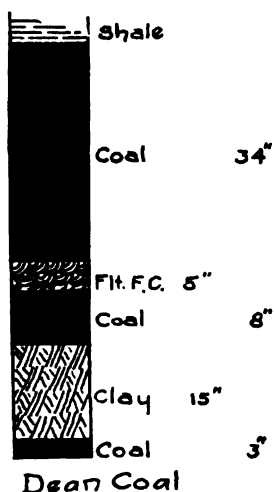


Fig. 73

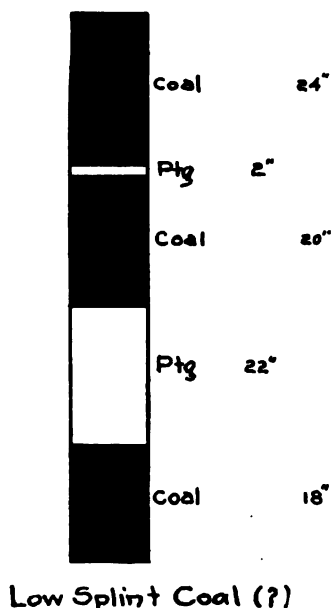


The coal at elevation 1760, figure 72, is about where the Low Splint coal should be, but in view of what was found near by, shown in figure 74, it seems hardly probable that this can be of that bed.

The Dean coal, at elevation 2110, is the next bed of figure 72 found of consequence. It is shown in detail in figure 73. Its opening is east of the drain in which are the lower coals of the section, and opposite the mouth of Fugitt creek.

Below the Dean opening a later one is reported with the section shown in figure 74. Its elevation was not obtained, but it is believed to be of the Low Splint coal.

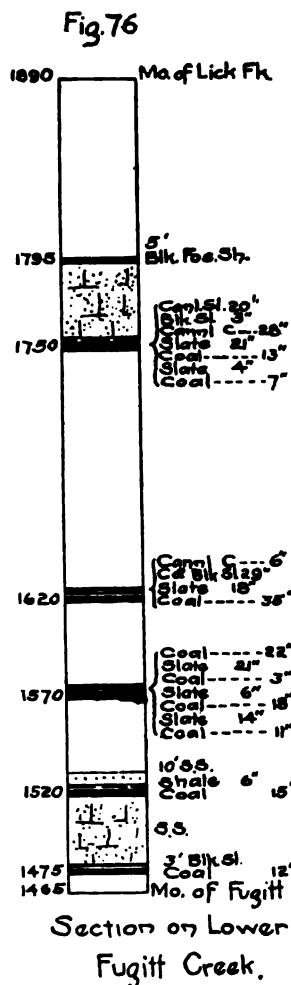
Fig. 74



FUGITT CREEK.

On the left, $17\frac{3}{4}$ miles up Clover fork; elevation of mouth, 1465.

The page-map, figure 75, drawn without aid of survey, shows the approximate location of streams and of coals noted. The distance from Clover fork to Grassy is about 5 miles. Wagons go up as far as Lick hollow, and thence a bridle path leads to Pounding Mill branch and Clover Lick creek. This is the main crossing of the mountain between Clover and Garrison gaps.



Inasmuch as the synclinal axis is approximately parallel to the general direction of the creek and not far from it, the dip should be slight on it, but it is to be remembered that the axis itself is about 200 feet higher on Clover Lick creek than on Clover fork above Fugitt creek, the distance being 6 miles.

Figure 76 shows coals found near the mouth of the creek. The coal at the bottom of the section with its black slate covering, is the same as that noted at the mouth of Joe's branch, 100 feet below the Keokee coal. It is exposed on the left, 100 yards up the creek.

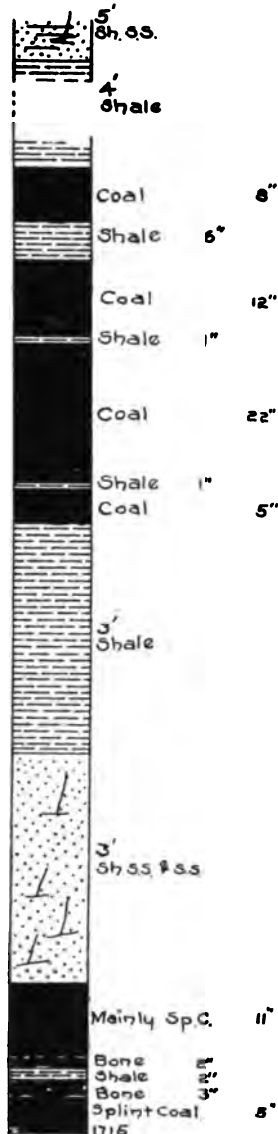
The Leonard and Keokee coals at 1570 and 1620 (approximately) are given as reported, the openings on the right of the creek, $\frac{1}{4}$ mile upit, having fallen in previous to visiting.

On the branch opposite these openings the top coal of the section was found. It is probably next below the Low Splint, that bed having cannel coal occasionally. The cannel slate looks at first sight like cannel, and the cannel is of doubtful quality.

In a cliff on the left, $\frac{1}{2}$ mile up the creek and by it, the following section of the Leonard coal is exposed, showing within 10 yards the variability of the bed:

15'	Sandstone.		
10'	Clay shale.		In.
	Black slate.....	9"	
	Coal.....	19 : 26	
	Shale.....	2" : 10"	
	Coal.....	3	
	Shale.....	7"	
	Coal.....	1 : 28	
	Fire-clay.....	6" : 36"	
	Coal (part splint).....	11 : 36	Elevation, 1570.
4'	Fire-clay, underlaid by 5' Sandstone.		

Fig. 77



Lower Fugitt Cr.

The coal of figure 77 is by the creek just above Laurel fork. It, probably, is of the bed next above the Keokee, but correlation is uncertain. The 5 feet of black fossil shale at elevation 1795, figure 76, with shells similar to those in shale on Razor fork, 30 feet below the Low Splint bed, if the same in each case would throw this bed well down toward the Keokee.

The Long Ridge section, figure 78, on the right from the mouth of Lick, or Petre-Rock, fork begins somewhat above the Low Splint coal. The Dean and Limestone coals cannot be recognized in the section, and it is quite possible that the latter, generally hard to find, is concealed below the coal at elevation 2395.

The coal at 2355 will answer for the thick bed below the Limestone coal on the head of Yokum creek.

The coal at 2650, reproduced in figure 79, is next below the High Splint coal, (also in both figures) a similar coal appearing in other Fugitt creek sections to follow, between the Cornett and High Splint beds. The variation in given intervals is in part due to the fact that openings are not made directly over one another, in part to barometric inaccuracy, and, probably in most part, to actual changes in the intervals.

Coals in figure 78 above the High Splint are given as reported by the foreman in charge of private work.

The lower coal of figure 80 is of the Cornett bed, as found on the right of Windy fork, $\frac{1}{8}$ mile below Grassy fork. Its bed section is given in greater detail in the bottom coal of figure 81.

The High Splint coal at elevation 2740 in figure 80, is from an opening under the cliff between Grassy and Windy forks, behind the old Isaac Creech house. Mr. Thruston's early measure of this coal gives the main seam 41 inches thick, with a parting of 7 inches below it and 5 inches more coal below that, which is now covered. His sample of the 41 inches, analyzed by Dr. R. Peter, yielded:

HIGH SPLINT COAL.	No. 2702
Moisture.....	1.56
Volatile combustible matter.....	35.04
Fixed carbon.....	60.80
Ash (light brownish gray).....	2.60
	100.00
Sulphur.....	.835
Coke.....	Spongy

"A fine splint or block coal. Some pieces breaking irregularly with shining surfaces."

The remainder of the section is from Mr. Thruston's notes. The mountain here rises to 750 feet above the High Splint opening, and allowing for rise of strata, the bed must still have somewhat over 700 feet of covering, and 400 at Grassy gap. The mountain ascends gradually to its highest point near the head of Razor fork, but the strata rise likewise, so that the covering of the High Splint bed along the summit to that point is generally within these limits.

An opening shown on the map on the left of Windy fork, as the High Splint at elevation 2680, gave 48 inches of clean coal, mostly splint, its roof not developed. The character of the coal determined its correlation, its 200 feet above the fossil limestone giving it the place of the Cornett bed. An error in its elevation is probable.

The High Splint opened on the right of Windy fork, at elevation 2715, is shown in the top coal of figure 81.

In the section of figure 82 the bottom coal is probably

of the Cornett bed, though much reduced in section compared with that on Windy fork. The High Splint, however, is increased to a more nearly normal section for Big Black mountain.

The coal of figure 83, reported of the High Splint bed and as found on Old Mill (Witt Mill) hollow, presents a most unusual section for that bed, yet it is probable that no mistake in it was made. It is thought likely that the partings would diminish greatly in a short drift underground.

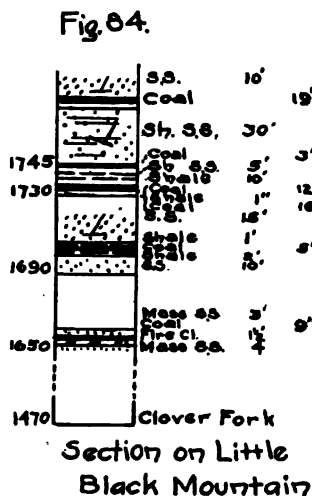


Figure 84 gives coals found in a drain on the right $\frac{1}{8}$ mile above Fugitt creek; that at elevation 1730 apparently of the Low Splint bed. It is quite possible that on development this would yield a section similar to that given in figure 74, a good workable coal.

On the left at $18\frac{1}{2}$ miles up Clover fork the Leonard bed has been opened, 50 feet above the creek, with the following approximate section:

	Inches.	
Coal.....	14	
Shale.....	8"	
Coal.....	3	
Shale.....	8"	
Coal.....	33	Elevation 1540

BEAR BRANCH.

On the left, $18\frac{7}{8}$ miles up Clover fork; elevation of mouth, 1500.

What appears to be the Keokee bed is exposed in a rockhouse, on the left, $\frac{1}{8}$ mile up the branch, 30 feet above the road. Its section is shown in figure 85.

Fig.86

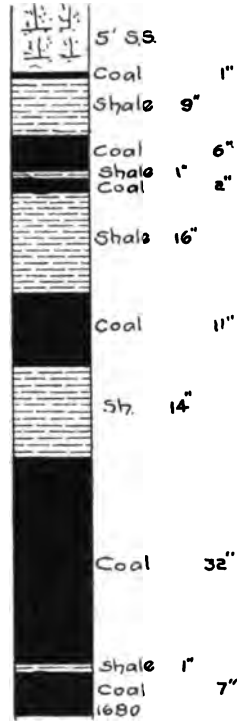
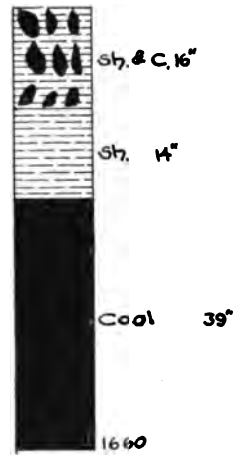
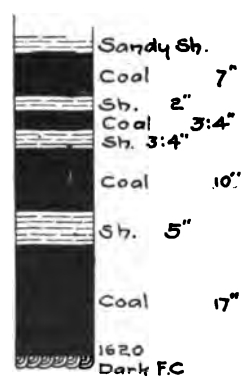
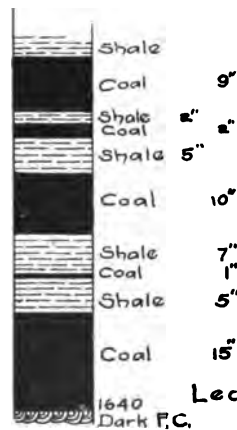


Fig.87



Keokee Coal



Leonard Coal

W. R. Bailey

In a small branch on the right, $19\frac{7}{8}$ miles up Clover fork, Wm. R. Bailey has opened the Leonard and Keokee coals with sections as shown in figure 86, and, again, the same beds, opposite the mouth of Child's creek, as represented in figure 87, the lower coal being in the first instance 105 feet above the creek and in the second 80 feet. In neither place does the Leonard coal, with its partings, present an attractive appearance, but the development of the bed here has led to the adoption for it in this report of the name of the post-office, Leonard, at the mouth of Child's creek.

The Keokee bed, also, is much injured by partings, but still gives its bottom coal in good condition for working similar to many openings already enumerated. Its section given in figure 86 was taken from a 10-yard entry. Mr. Thruston's measures taken before the entry was started were nearly similar, as were McCreath and D'Invillier's, both parties getting samples at that time. Analyses of them are given below, the former's, of 44 inches coal in the two lower seams, by Dr. R. Peter under No. 2690, the latter's, of 39 inches coal in the same lower seam, in the last column.

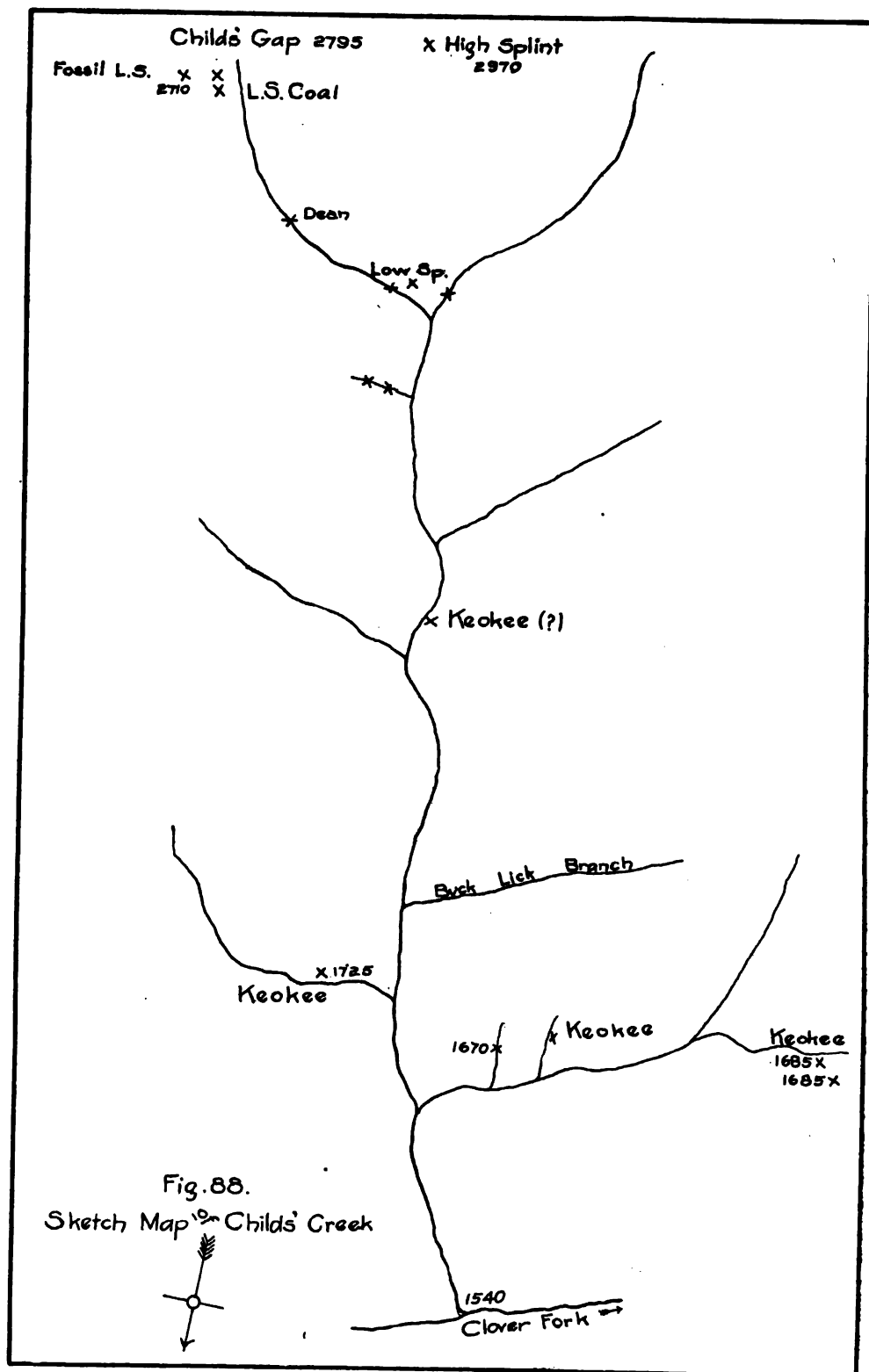
KEOKEE COAL.	No. 2690	McC.
Moisture	2.46	2.260
Volatile combustible matter	31.94	37.270
Fixed carbon.....	61.20	57.661
Ash.....	4.40	2.270
Sulphur	100.00 .538	.539
Color of ash	Light brown	100.000 Reddish gray.
Coke.....	Dense	

CHILDS CREEK.

On the right, 20 miles up Clover fork; elevation of mouth, 1540.

The page-map, figure 88, shows in a general way the location of coals found on this stream, the distance from its mouth to Child's gap being about 3 miles.

The coal with black slate covering, 100 feet, more or less, below the Keokee bed, has been taken from along the



creek, near its mouth at elevations about 1545 to 1550. Strata above this coal are seen rising quite rapidly in going up the creek and its branches for the first mile, but farther up the dip is very slight if not reversed. What is probably the Keokee coal at elevation 1680 two miles up the creek is at elevation 1825 at the Darby mines on Gin creek in Virginia. (Elevation 2111 by the mine levels.)

Right Fork. One half mile up Child's creek.

Figure 89 shows coals, beginning with the Keokee at the bottom, found $\frac{3}{4}$ mile up the Right fork, on a right branch. The Keokee bed-section resembles that of the entry on the north side of the same hill, given in figure 86.

Fig. 89

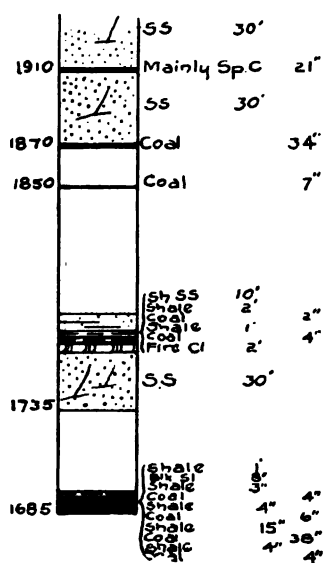
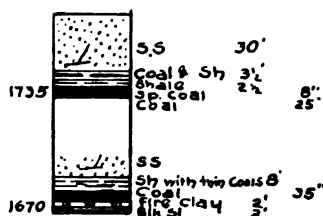
Section on Right of
Right Fork

Fig. 90

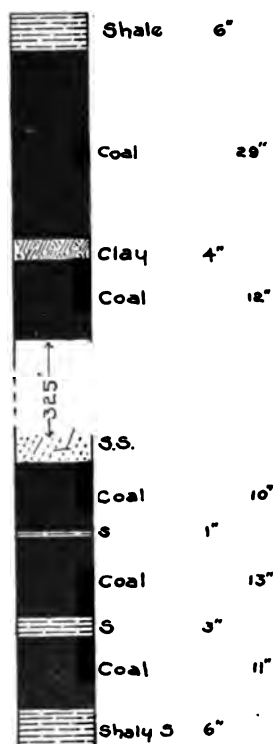
Section on Left of
Left Fork

In the group of coals at the top of figure 89 is evidently the Low Splint bed. The splint in the upper member is in favor of its correlation therewith.

Both the Leonard and Keokee beds have been opened on the left of this fork, with sections as shown in figure 90.

A quarter mile up a left branch $\frac{3}{4}$ mile up Child's creek, at elevation 1725, is an entry into the Keokee coal 30 inches thick, largely splint coal, with 3 inches of shale between it and massive sandstone above; all the seams of coal and shale on top of the main coal in openings of this vicinity having disappeared.

Fig. 91



B. F. Parsons

Buck Lick Branch. On the right one mile up Child's creek.

Mr. Thruston found two coals on this branch, on Ben F. Parson's land, which are given in figure 91. Their elevation is not known, but their given interval of 325 feet and their character of bed-section places them, with little doubt, as the Low Splint and Dean coals. His samples of these coals analyzed by Dr. R. Peter, gave the results following, No. 2688 of the lower bed and No. 2689 of the upper:

	No. 2688	No. 2689
Moisture.....	1.80	1.80
Volatile combustible mat.....	35.00	33.60
Fixed carbon.....	57.30	55.20
Ash.....	5.90	9.40
Sulphur.....	100.00	100.00
Color of ash.....	.986	.821
Coke.....	Light grayish brown.	(Purplish) nearly white.
	Dense spongy	Spongy.

No. 2668. "Generally splint coal. But little fibrous coal and no pyrites apparent. Some ferruginous incrustation. Portions breaking irregularly, with pitch-black, irregular surfaces."

No. 2689. "A mixed sample. Some splint coal, with fibrous coal between the laminae, but no apparent pyrites; other portions breaking irregularly, with pitch-black, shining surfaces."

On the left, $1\frac{1}{4}$ miles up Child's creek, what appears

Depth (ft)	Stratigraphic Unit	Thickness (ft)	Dip (°)
2970	Cong. ss. (Shale Part Sp. C. (Coal)	4:12"	36° 13'
2840	SS. Cliff		
2795	Childs Gap		
2710	Fool. L.S.	16"	
2650	Bony C. Shale Splint C. Bone Hard Blk. ss. Coal & Sh.	6" 13" 13" 2 1/2" 1 1/2"	6° 13° 10°
2630	(Coal) (Shale) (Coal)	2 1/2"	25° 18'
2360	Shale Splint C. Thin F.C. Splint C.	7"	20° 6'
2340	Cannel Sl.		11°
2190	Sh. ss. Coal ls. clay	1'	6°
2060	Splint Coal		1'
1975	sh. ss. Shale Coal Shale Coal	1' 5"	15° 7°
1955	Best L.S.	6"	
1940	ss. ss. ss.		4°
1925	ss. Fire clay		10°
1680	40' ss. 2' Sh & Blk. Cl. 10' ss. & Sh. ss. Shale Coal		30°

KENTUCKY GEOLOGICAL SURVEY. 91

to be the Leonard bed shows, under a cliff, the following section:

Ft.		In.
10	Sandstone.	
	Coal.....	8
	Fire-clay..... 2'	
	Coal.....	3
	Black slate..... ½'	
	Coal.....	9
	Shale..... 2'	
	Splint coal.....	2
2	Fire-clay.	Elevation 1640
8	Sandstone.	

And 100 yards beyond, under a fall, the same bed is reduced to 19 inches of coal with one thin parting.

An old opening in the right branch of Child's creek, $1\frac{1}{2}$ miles up, elevation 1680, reported to have about $2\frac{1}{2}$ feet of coal, is assumed to be of the Keokee bed, and is made the base of the section of figure 92.

The Low Splint bed, or its neighbor, is shown in the section, at elevation 1975, as found in the bed of the Left fork. This coal was also found on the left below the forks and to the right of the path, at elevation obtained as 2040, which is probably too high; also on the hill between the forks, 20 feet above the Left fork; and in the bed of the Right fork, at which points it gave the following sections:

BELOW FORKS.		BETWEEN FORKS.		RIGHT FORK.	
Ft.	In.	Ft.	In.	Ft.	In.
Shale.		10 Sandstone.		Sandstone.	
Coal.....	6	1 Black slate.		Cannel slate.....	9
1½ Shale.		Coal.....	12	Shale.....	4
Coal(mainly splint) 20		Black Slate.....	5	Bone coal.....	1
Slate and shale....	2	Coal.....	8	Splint coal.....	16
Coal(mainly splint) 7		Coal (hard).....	6	Shale.....	6
				Splint coal.....	18
Elevation, 2040 (?)		Elevation, 1970.		Elevation, 1985.	

The Dean coal, at elevation 2360, is given in figure 92, as found by Mr. Thruston on its first discovery. His sample then taken yielded to Dr. R. Peter's analysis:

DEAN COAL.	No. 2687
Moisture.....	2.20
Volatile combustible matter.....	33.52
Fixed carbon.....	55.72
Ash (light yellowish-gray).....	8.56
	100.00
Sulphur.....	.656
Coke.....	Dense, friable.

No. 2687. "A hard splint coal, dull black, with but little fibrous coal and no apparent pyrites."

The latest measure at this point, in the bed of the stream, gave the section of figure 93, an improvement on the former due to the exposure being more nearly under roof.

The two beds shown at elevation 2630 and 2650 of figure 92 are evidently a consolidation into two distinct beds of the numerous seams on the head of Yokum creek included under the name of Limestone coal. These bed-sections are given in this figure as reported by McCreath and D'Inwilliers, and their analyses of the coals are given below, that of the lower bed in column A, and of the upper bed, including only its 52 inches of the middle portion, in column B. The analyses, in their small amounts of ash indicate that what is called slaty coal is a good fuel.

In figure 93 the same two beds are given with Mr. Thruston's measurements, but since that time the opening has been carried to roof with a thickening of the 6-inch upper seam of coal to 12 inches. Analyses are also given, as made by Dr. R. Peter, of Mr. Thruston's samples of the lower bed (opened by the path to Child's gap), 40

Fig. 93

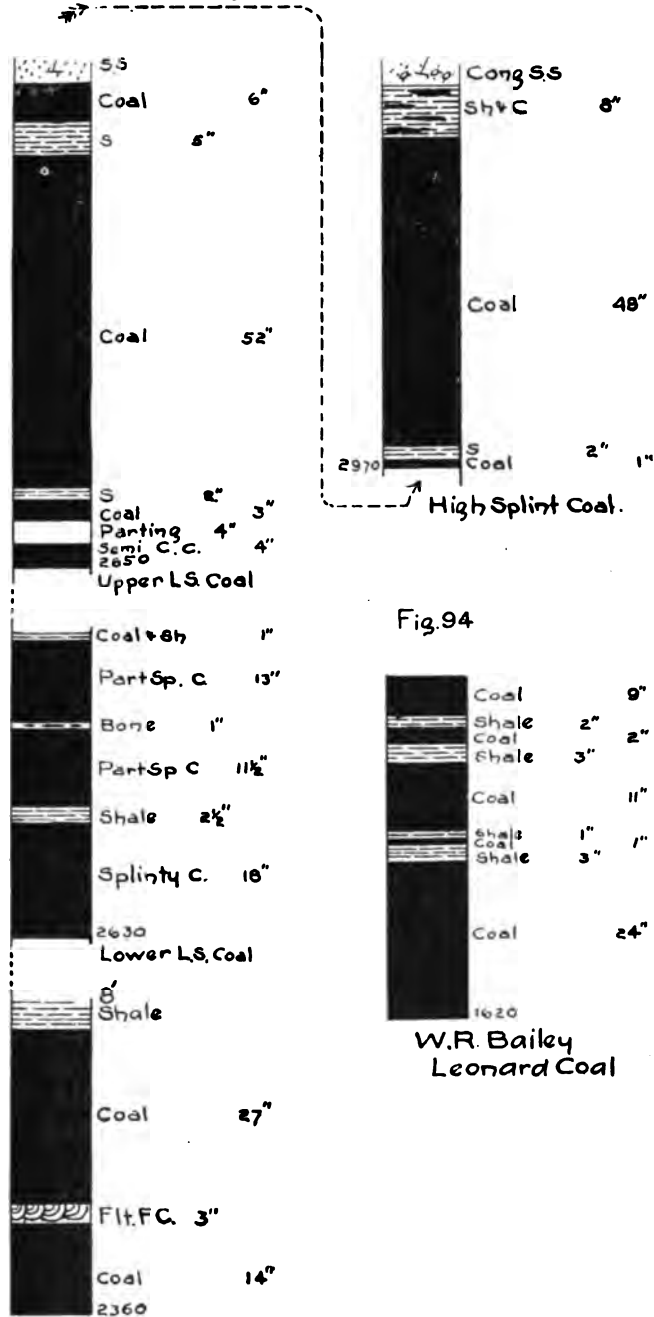
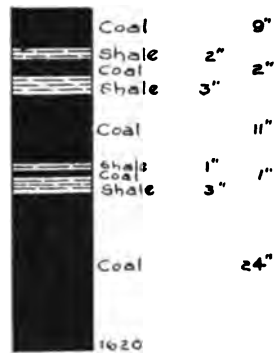


Fig. 94



W.R. Bailey
Leonard Coal

Dean Coal
Head of Child's Cr.

inches of the 44-inch seam, No. 2686; and at "a better opening," near-by, No. 2693; also, from the upper bed, of the 36 inches splint, the lower part of the 52-inch seam, No. 2698; and of the upper 16 inches of that seam combined with the 3-inch seam below it, No. 2696.

LIMESTONE COAL.	Lower Bed.			Upper Bed.		
	A.	2686	2693	B.	2698	2696
Moisture.....	1.838	6.18	2.00	3.806	2.16	2.00
Vol. combust. matter.....	37.217	34.24	36.80	37.649	23.14	35.00
Fixed carbon.....	51.347	52.88	55.86	53.486	55.50	52.20
Ash.....	8.530	6.70	5.34	4.320	8.20	10.80
Sulphur.....	1.068	100.00	100.00	.739	100.00	100.00
		.519	.958		.684	.959
Color of ash.....	100.00 Reddish gray.	Light buff.	Purplish gray.	100.000 Reddish gray.	Light gray.	Light purplish gray.
Coke.....		Pulver- ulent.	Light spongy.		Dense.	Dense.

No. 2686. "Sample from the outcrop, badly weathered."

No. 2693. "Mostly splint coal, showing but little rous coal, breaking somewhat irregular, with bright irregular pitch-black surfaces."

No. 2698. "Sample shows but little fibrous coal and no pyrites."

The fossil limestone, at elevation 2710, is well exposed, 16 inches thick, in the two drains to the left of the Limestone coal openings by the path. Its shells are abundant here.

The High Splint coal shown at the top of figure 93, as measured by Mr. Thruston, is exposed, at elevation 2970, in a rockhouse $\frac{1}{2}$ mile west of Child's gap. Similar to its usual condition on Big Black mountain its lower half is here splint coal. The shale roof shows a variation in thickness from 4 up to 12 inches.

Mr. Thruston's samples of the upper and lower 24 inches of the 48-inch seam, respectively, were analyzed by Dr. R. Peter, with the following results:

HIGH SPLINT COAL.	No. 2691	No. 2692
Moisture.....	4.50	2.50
Volatile combustible matter.....	33.00	38.60
Fixed carbon.....	58.90	53.04
Ash.....	3.60	5.86
Sulphur.....	100.00	100.00
Color of ash.....	.628	1.425
Coke.....	Salmon. Pulverulent	Grayish bro'n Spongy.

No. 2691. "The sample seems to have been weathered."

No. 2692. "Contains some fibrous coal, but no apparent pyrites. Some pieces break irregularly, with bright shining, pitch-black, irregular surfaces." The high sulphur is exceptional in the coal of this bed.

The 4 feet coal of this opening is probably a minimum or near it, in this locality. Between this point and the head of Yokum creek is an area of the coal which, in view of its fine quality may well prove workable under present conditions. Railroad lines are now built to within about a mile of the outcrop on Fawn branch, Bailey's Trace and Gin creek, in Virginia, and the extreme height of the bed, about 1200 feet above railroad, alone delays attack upon it.

According to contours of the U. S. Geological Survey map, the height of Little Black mountain, and also opposite on Big Black mountain, is about 300 feet lower than by elevations given herein. The latter have been so far checked as to prove them, almost surely, nearly correct. They lie about midway between the U. S. contours and the elevations as given at Darby.

GIN CREEK, VIRGINIA.

The Darby mines at the head of this creek are in the Keokee bed, called here the No. 5. The coal, without parting, runs from 2 to 3½ feet thick, with an average of perhaps 3 feet, largely splint coal. Owing to its excellent quality and consequent high price the thin coal can be mined, although the works are on a small scale. The elevation above tide at the mines is given as 2111, but according to the system employed for this report it is 1800,

making a fall northward to the upper Keokee opening on Child's creek of 120 feet in a distance of 3 miles or more.

The Low Splint bed, (No. 6) about 240 feet above the Keokee, is said to be badly split on Gin creek, but it is mined on the head of Straight creek, the next stream to the east.

The Dean bed (No. 7), 530 feet above the Keokee, has $2\frac{1}{2}$ feet of coal, reported with 7 per cent. ash, above its 6 inches fire clay parting and 9 to 21 inches bony coal below it, said to contain 10 to 12 per cent. ash.

A bed 90 feet above the Dean, called the "Big and Dirty," ribbed coal and shale of perhaps 5 feet, is remarkable in having fossil shells in its shale roof.

At 180 feet above the Dean is No. 8, the thick coal on the head of Yokum creek, about 90 feet below the Limestone coal. This has here the following section:

	In.
Shale.....	
Coal.....	13
Shale..... 1"	
Coal.....	1
Shale..... 3"	
Coal.....	1
Shale..... 11"	
Coal.....	38

The bottom seam is a good bright, black coal, and the bed appears well worth full investigation.

The lower one of the twin Limestone coals (No. 9) about 270 feet above the Dean, is here 51 to 57 inches clean coal with a little splint in the middle, the lower foot rather heavy with ash.

The upper Limestone coal (No. 10) 15 to 20 feet higher has, in three openings, 48 to 69 inches coal, with but a mother coal parting in the former, and partings of 3, 4 and 1 inches in the latter.

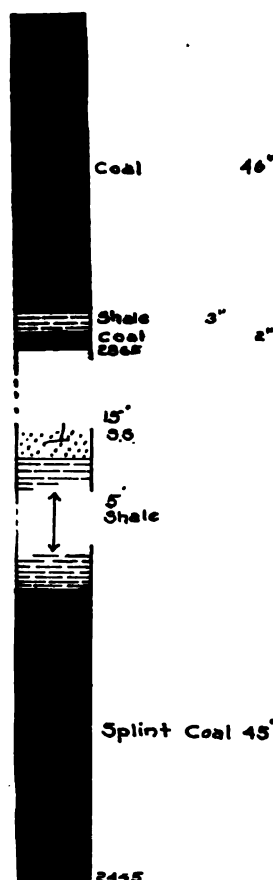
On the right of Clover fork, $20\frac{1}{4}$ miles up, the Leonard bed has been opened, 70 feet above the creek, with the section of figure 94 (see page 93.)

Fig. 95

KANAH WINN BRANCH.

On the left $20\frac{5}{8}$ miles up Clover fork; elevation of mouth, 1565.

In addition to the two coals shown in figure 95 the following were found by Mr. Thruston, but their correlation is not attempted:



Kanah Winn Br.

	Elevation.
Fossil limestone.....	2555
Coal.....	2045
Lower fossil limestone.....	2015
Castellated sandstone (20 ft.).....	1965
Coal.....17 in.	1940
Ribbed coal and shale.....28 in.	1865
Coal.....24 in.	1825
Coal.....20 in.	1780
Ribbed coal and shale.....46 in.	1755
Coal.....24 in.	1705
Ribbed coal and shale.....46 in.	1645

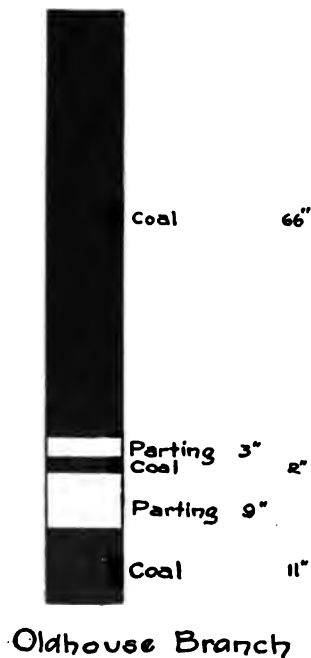
The fossil limestone at elevation 2015 is probably of too rare occurrence to serve in correlations, but that one 540 higher has been found of much use for the purpose. Probably nowhere else is it more prolific of shells than on this branch, where its outcrop can be followed with ease from the main branch to the dividing spur on the right, $\frac{3}{4}$ mile up the branch.

The Limestone coal, the lower of figure 95, shows 45 inches of remarkably bright splint coal, on the right, $1\frac{3}{4}$ miles up the branch. An earlier measurement gave 42 inches, and still earlier by Mr. Thruston 36 inches, but whether of the same opening less developed or of another near by is somewhat uncertain.

Mr. Thruston measured the upper coal, the High Splint, and sampled the 46-inch seam, from which the following results were obtained by Dr. R. Peter:

HIGH SPLINT.		No. 2695
Moisture.....	1.80	
Volatile combustible matter.....	37.10	
Fixed carbon.....	56.70	
Ash (light purplish gray).....	4.40	
		100.00
Sulphur.....	.964	
Coke.....	Light spongy.	

Fig. 96



No. 2695. "Generally a pure-looking coal, mostly breaking with bright irregular surfaces, pitch-black. Some portions more dull, breaking into laminae, with fibrous coal between. Some bright pyrites apparent."

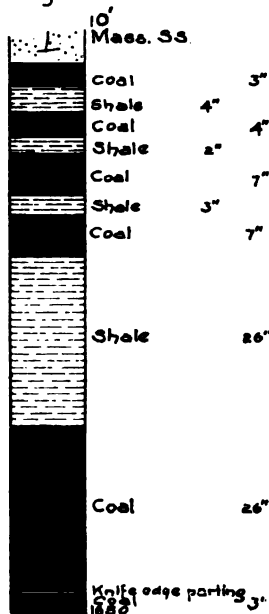
OLDHOUSE BRANCH.

On the left, 21 miles up Clover fork; elevation of mouth 1585.

The coal of figure 96 is reliably reported on this branch as shown. Its height is not known, but, reported of the High Splint bed it is undoubtedly of that or of the Cornett bed.

In the next 2 miles above Oldhouse branch along Clover fork are numerous exposures of the Keokee coal. A few of these are given in the sections below, which show the quick variations of the bed and its adjacent strata common to the region. (The sandstones at the top and bottom of the sections are given the thicknesses seen when noted. Their actual thicknesses are supposed to be nearly uniform.) The Ely entry of figure 97, on the left, 22 miles up Clover fork, 15 feet above it, also serves in illustration.

Fig. 97



Keokee Coal

Ely Entry

ON RIGHT, 21¼ MILES.

Feet	
	Massive sandstone.
3	Coal with 4 partings.
5	Shale.
3	Coal with 4 in. and 1 in. partings. Elev. . 1665
1	Fire-clay.
2	Shale.
	Coal, 2 in.
45	Sandstone.
10	Covered (Leonard coal ?)
5	Clover fork. Elevation . . 1600

ON RIGHT, 21¾ MILES.

Feet	
30	Sandstone.
10	Shale.
	Coal, 24 in. Elevation 1660
10	Shale.
25	Sandstone.
	Clover fork. Elevation . . 1625
15	Massive sandstone.
	Coal and three partings, 20 in.
	Shale . 15 in.
10	Covered.
	Coal, 34 in. Elevation . . 1645

The bottom coal of the last section having been covered by water of the creek, a foot deep, its thickness was uncertain, and a parting may have been undetermined.

The coal which here goes below the creek rises again shortly, and runs again below it under the dam, ⅛ mile below Breeding creek, with 9 inches of coal under sandstone and above a clay parting of 6 inches, below which is more coal and clay. Farther up the creek the bed gets well above it again.

BREEDING CREEK.

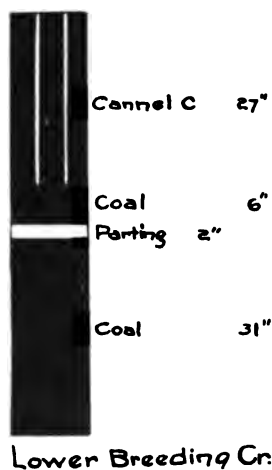
On the left, 23⅛ miles up Clover fork; elevation of mouth, 1675.

In a cliff on the right, ⅛ mile up the creek, is 2 feet or more of a hard block coal under black shale, at elevation 1780. This is probably the lowest of the group of Low Splint coals. In a rockhouse on the left, ¼ mile up

the creek and at the same elevation the following is exposed, of a bed perhaps 20 feet higher than the preceding, supposed to be next under the main Low Splint bed.

20'	Sandstone.	In.
10'	Shale.	
	Cannel coal.....	4
	Shale..... 2"	
	Cannel coal.....	5
	Clay..... 6"	
	Coal.....	2
	Clay..... 2"	
	Coal.....	1

Fig. 98



Information was obtained, but the opening was not found, of a coal on this creek, supposed to be of the same bed as that just noted, having the section of figure 98. The measurements given are probably correct, but there is uncertainty as to whether or not the top seam is cannel, or indeed, if it be not cannel slate like that of the same bed on Fugitt creek.

Right Fork. The bottom coal of figure 99, the Low Splint, is exposed in a rockhouse on the right, at the first forks of the creek. The remainder of the section was obtained from a steep drain on the right, $\frac{1}{4}$ to $\frac{1}{8}$ mile up the

Right fork. The Dean coal is probably that at elevation 2140 but the distinctive fire-clay did not appear. The Limestone coal is probably above the upper sandstone shown, the fossil sandstone being much too low to represent the fossil limestone.

While it is nearly proven that there is no thick coal in outcrop at this point other than the covered high coals near the top of the spur, variability of the beds of the region is such that there is still reason to look for better prospects in the vicinity.

Fig. 99.

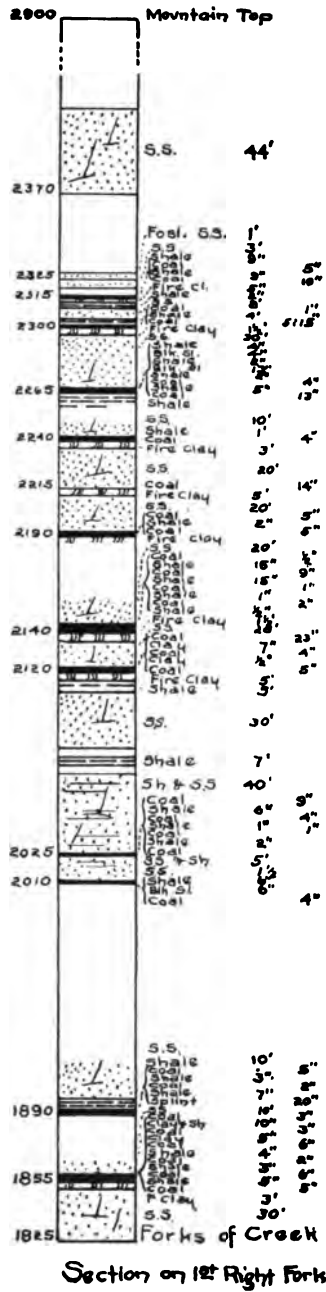
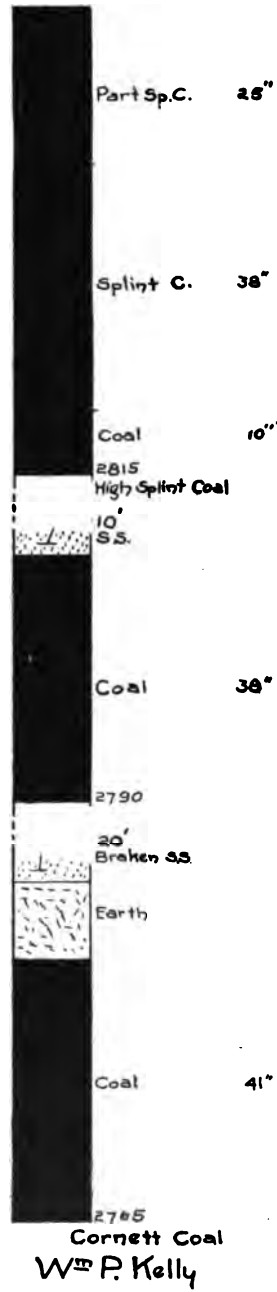


Fig. 100



From the forks of the left fork, (elevation, 2270), $1\frac{1}{2}$ miles from Clover fork, on the left $\frac{1}{4}$ mile up the Left fork the coals of figure 100 were opened, and again, on the right $\frac{1}{2}$ mile up the same Left fork old openings, reported as of the Cornett and High Splint coal, were found at elevation 2880 and 2945, respectively, showing a rapid rise up stream here. This rise however, appears to be due, in most part, to a thickening of strata between the fossil limestone and Cornett coals from about 250 feet on the west to about 350 feet on the head of Breeding creek and eastward.

The fossil limestone was found on the second Right fork, below Mose gap, at elevation 2530, and Mr Thruston found the following on the same stream:

	Elevation.
Coal stain	3000
Coal.....26 in. }	
Splint Coal.....6 in. }	2920
Floating fossil limestone.....	2680

But some uncertainty exists as to these elevations relative to others given. The lower coal appears to be of a bed just below the Cornett, while the coal stain, at elevation 3000, is probably of the High Splint bed.

His sample of the 32-inch coal analyzed by Dr. R. Peter gave the following results:

32-IN. COAL.	No. 2694.
Moisture.....	2.06
Volatile combustible matter.....	37.34
Fixed carbon.....	57.70
Ash (purplish gray).....	2.90
	100.00
Sulphur.....	.574
Coke.....	Spongy.

"Generally hard, dull-black, breaking into irregular laminae with but little fibrous coal, and no apparent pyrites."

The following notes may prove of service:

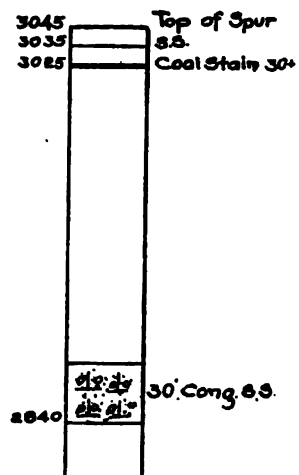
Mose gap, elevation 3275.

Indian Grave gap, $\frac{1}{2}$ mile west of Mose gap, elevation 3355.

Coal, 100 yards west of Indian Grave, elevation 3330.

Peak, head of Breeding, Head and Huff creeks, elevation, 3745.

Fig. 101



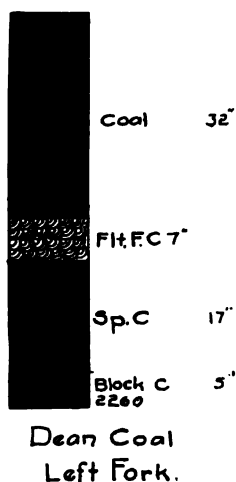
At water level on the left, $23\frac{1}{4}$ miles up Clover fork, the Keokee coal has the following section:

	Inches.	
Ribbed coal and shale.....	40"	
Shale.....	3"	
Bony coal.....	3	
Hard coal.....	22 : 28	Elevation 1680

DAY'S CREEK.

On the right, $23\frac{3}{4}$ miles up Clover fork; elevation of mouth, 1710.

Fig. 103



The section of figure 101 represents coals found from the mouth of the creek to its forks, $\frac{3}{4}$ mile up, and thence up the Left fork to the top of the ridge, about a mile from the top of Little Black mountain.

The Keokee coal being below drainage at the mouth of the creek, that at elevation 1890, with a heavy sandstone above it, seems to correspond with the main Low Splint bed, though low when compared with the Dean coal at elevation 2260.

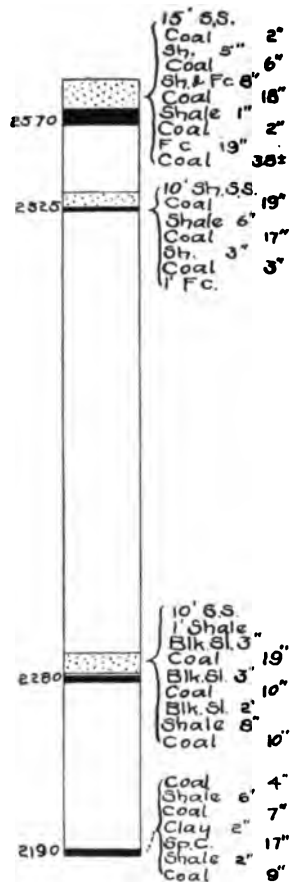
The Dean coal, of figure 103 also, here shows workable thickness for the last time in going up Clover fork. Above it for 200 feet the measures are almost wholly thin-bedded.

The coal stain at the top of the section is probably of the High Splint bed. Its thickness may be far in excess of that seen.

In figure 102, is shown the coals found in a left drain of the Right fork, a mile from Clover fork.

The lowest coal of this section, with 37 inches of coal, as in figure 101, possibly represents the Vanderpool bed of the Jellico region. It is shown, the bottom coal of figure 103a, though its partings, like the other coals of this figure, and its doubtful area, put it rather without the range of workable coals.

Fig. 103a



Section on Day's Cr.

The Dean coal being thin here indicates a very much restricted area workable in this vicinity. The coal at elevation 2280 is not known to be of equal thickness elsewhere, and that at elevation 2525 appears to be the eastern limit of workable thickness of the bed under the Limestone coal. The Limestone coal, at elevation 2570, though somewhat better than the others, is also probably near the eastern limit of its workable coal in Little Black Mountain.

ROCKHOUSE CREEK.

On the right, $25\frac{1}{4}$ miles up Clover fork; elevation of mouth, 1730.

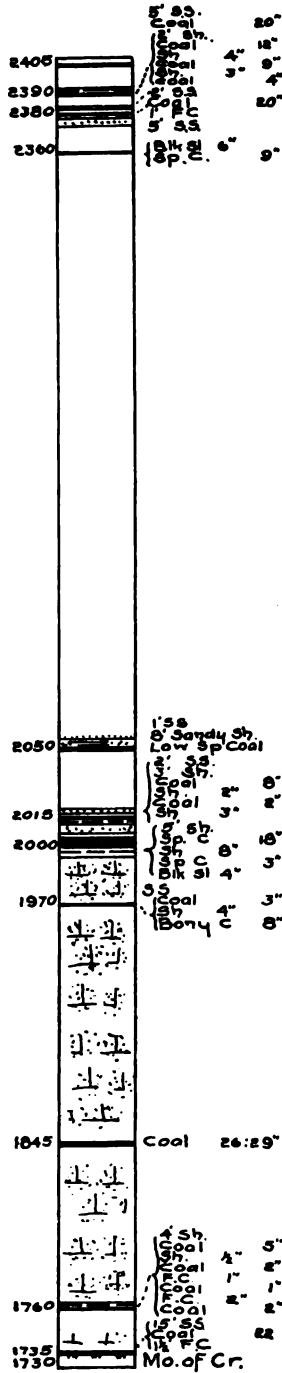
Figure 104 shows coals found along the creek from its mouth to its forks, and thence up the Right fork and its first left branch.

Again the Keokee coal rises above drainage, appearing behind a fall of the creek, 50 yards above its mouth.

On the first right branch, $\frac{3}{8}$ mile up the creek the following section was obtained:

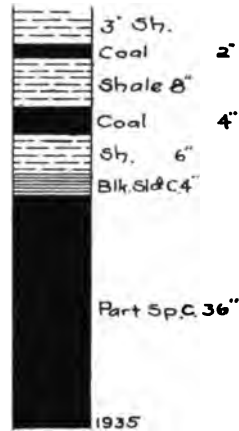
Feet	Inches	
15 Sandstone.		
10 Red shale.		
Splint coal.....	17	Elevation 1945
10 Shale.		
3 Shaly sandstone.		
Splint coal.....	12	
Shale.....	15	
Coal.....	4	Elevation 1930
2 Shaly sandstone.		
10 Massive sandstone.		
10 Shaly sandstone.		
Shale.....	5	
Coal.....	8	Elevation 1905

Fig.104



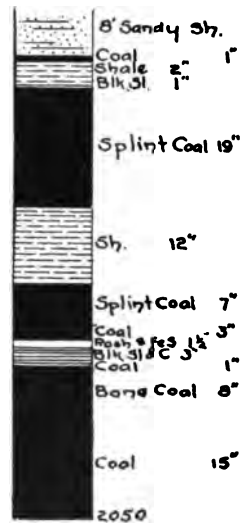
Section on Rock-house Creek.

Fig.105



Low Splint Coal
2^d Right Bt

Fig.106



Low Splint Coal
John Witt

The middle coal dips northeast about 1° and the upper coal 8° . The latter dip must be confined to a few yards, and may be the effect of heat from burning coal, which probably colored red the shale above it. The coal is of the Low Splint bed.

This same bed was opened on the second right branch, $\frac{1}{2}$ mile up the creek with the section of figure 105, and again on a small branch of the Left fork, 150 yards southwest of the house in the forks occupied by John Witt, with the section of figure 106, (see page 105). It is also opened north of the Witt house with about the same section, and in a branch on the left of the main stream, $\frac{3}{4}$ mile up, $\frac{1}{4}$ mile northeast of the Witt house with this section:

Feet	Inches	
2	Shale.	
	Coal stain.....	9
7	Shale.	
	Coal	46
		Elevation 2060

An attempt was made to find the Dean Coal, because of its favorable showing on Day's creek, which resulted in getting the higher coals of figure 104. If it was found the absence of its characteristic parting prevents its identification.

No coal of workable thickness and area has been found above the Low Splint in Little Black mountain east of Rockhouse creek.

The section of figure 107 was taken on the right of Clover fork, $25\frac{1}{2}$ miles up it, opposite the old Short Store. The bottom coal, at creek level, is here the Keokee. The coal, not opened, at 1990, probably the Low Splint. It appears to be thin.

The Keokee coal shows, again, on the left of Clover fork, $25\frac{3}{4}$ miles up it, elevation 1750, with 26 inches of coal, on which is 3 or 4 feet of slipped coal, crushed shale and broken sandstone, indicating perhaps, 2 feet more of coal in the bed. The heavy sandstone above it seems to have squeezed out the upper portion of the bed at its outcrop.

creasing distance from the synclinal axis than to any local disturbance. The upper bed is probably the Low Splint, the interval between the two beds showing greater than is actually the case, because of the rise of strata in going from the lower opening to the higher.

Fig. 109



Keokee Coal
Wright Short.

The continued rise of strata brings the Leonard bed above the creek at Wright Short's, $26\frac{5}{8}$ miles up Clover fork, where on the right, the following section is exposed:

Feet	Inches	
30	Sandstone.	
	Cannel coal.....	30
	Fire-clay.	
25	Sandstone.	
	Coal.....	14
	Shale.....	1"
	Coal.....	12
	Fire clay... 9"	
10	Sandstone.	
	Clover fork.	
		Elevation 1815
		Elevation 1785
		Elevation 1775

The cannel coal shown in figure 109 is of the Keokee bed, and though of excellent quality is most inconstant, so far as its outcrop indicates, for on the right, 150 yards farther up, in the point of the hill, it was opened with but 11 inches cannel lying on 24 inches of common coal. On it is a shattered sandstone cliff about 40 feet high.

The Leonard bed is in the creek 50 yards farther up.

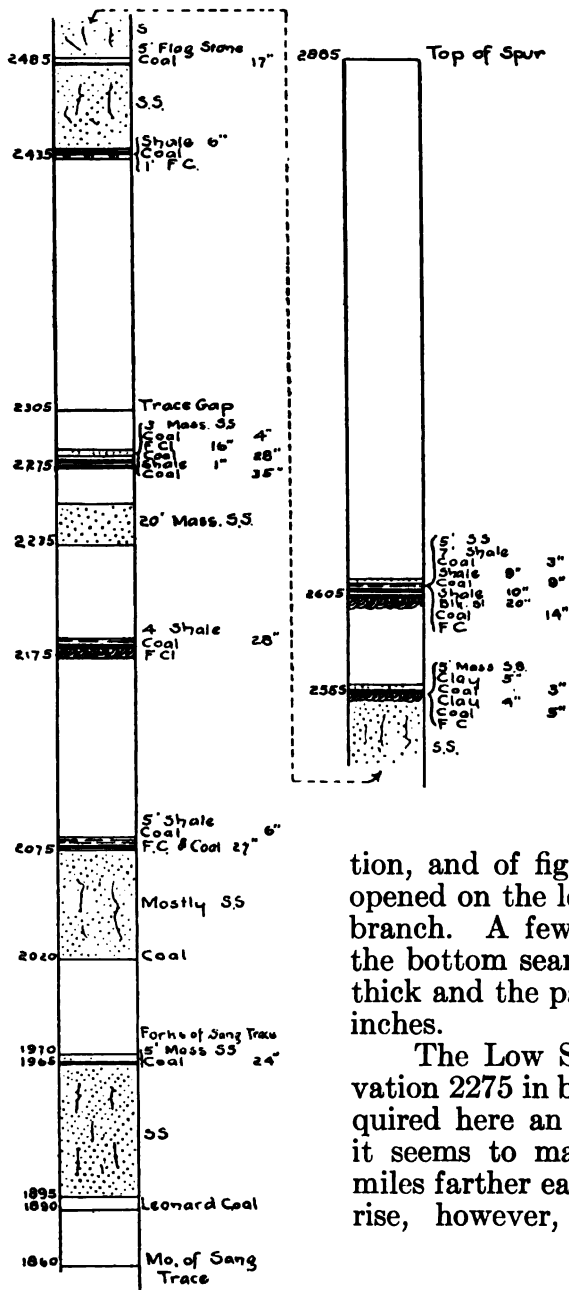
On the left, by the road, $27\frac{1}{4}$ miles up Clover fork, 20 feet above it, the Leonard coal is opened in a short entry on Jasper N. Holmes' land, with the bed-section of figure 110. The lower part of the bottom seam of this coal is largely splint and the whole has a strong likeness to the Keokee bed, which it has been assumed to be, but comparison of the levels of the two

Fig. 110



Keokee Coal
Jasper Holmes

Fig. III



Section on Sang Trace

beds up and down Clover fork, and its relation to the Low Splint bed on Sang Trace, prove it of the Leonard bed.

SANG TRACE.

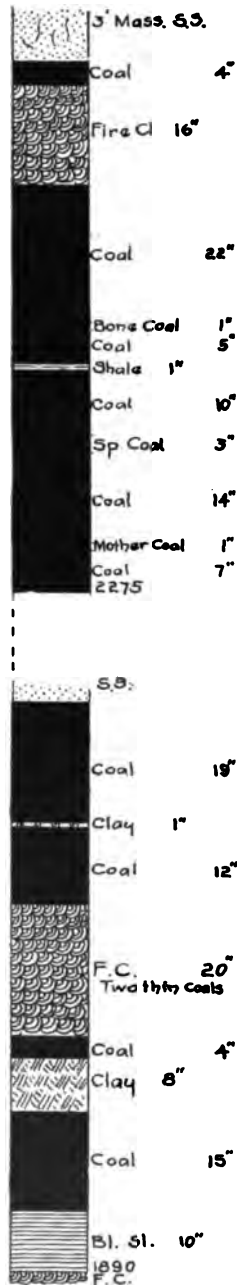
On the right, 27½ miles up Clover fork; elevation of mouth, 1860.

The section of figure 111 shows the coals on this branch, with their apparent intervals more or less increased because of rise of strata.

The Leonard coal at the bottom of the section, and of figure 112, also, was opened on the left, ⅓ mile up the branch. A few yards farther up the bottom seam is but 12 inches thick and the parting on it only 5 inches.

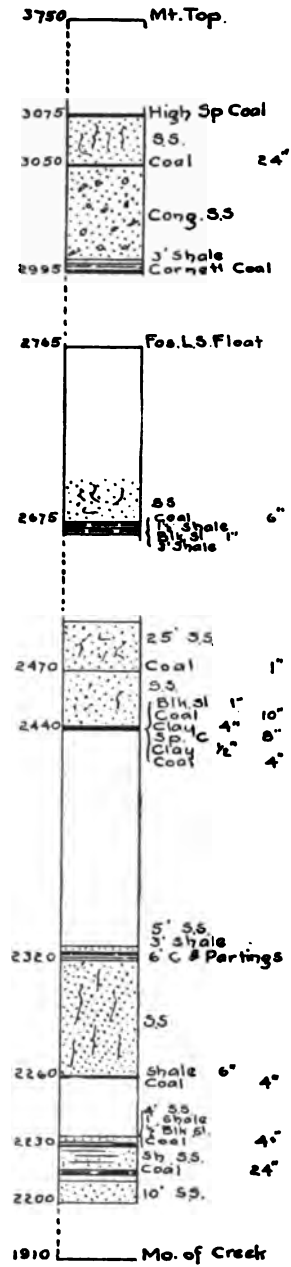
The Low Splint coal, at elevation 2275 in both figures, has acquired here an importance which it seems to maintain for several miles farther east. Its southward rise, however, renders its area

Fig. 112



Sang Trace

Fig. 113



Section on Head's Cr.

Leonard Coal

more restricted in this part of Little Black mountain than would appear from its height here. But though only 30 feet under the very low Trace gap at the head of Sang Trace, it still has an area of much value.

HEAD'S CREEK.

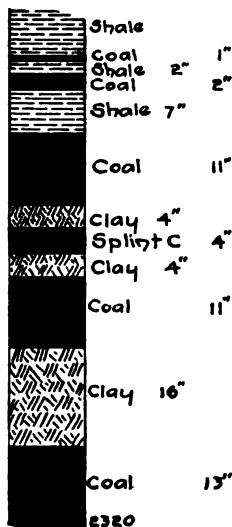
On the left $27\frac{3}{4}$ miles up Clover fork; elevation of mouth, 1910. This elevation gives a rise of 50 feet in Clover fork in the quarter mile from Sang Trace, a rise probably double the actual amount, but, as the point of error cannot be ascertained at this writing, correction is not attempted. It is only necessary to bear in mind that the coals just below this creek are, relatively to those here and just above, placed 25 to 30 feet too low.

In the section of figure 113 the coals below the fossil limestone were taken so nearly one above another that the dip has little effect on the apparent intervals, while the higher coals were found where the dip is too slight to take into account.

The Holmes house at the mouth of the creek is about on the level of the Leonard bed, which would bring the Low Splint in as one of the three lower coals of the section, with dip not taken into account. The lowest coal, however, exposed on top of a waterfall, $\frac{3}{8}$ mile up the creek, shows a northwest dip of about 5° , so that the Low Splint may be considerably lower, and in that case the coal at 2320, shown enlarged in figure 114, or that at 2440, is possibly of the Dean bed; or it may not have been found on this creek.

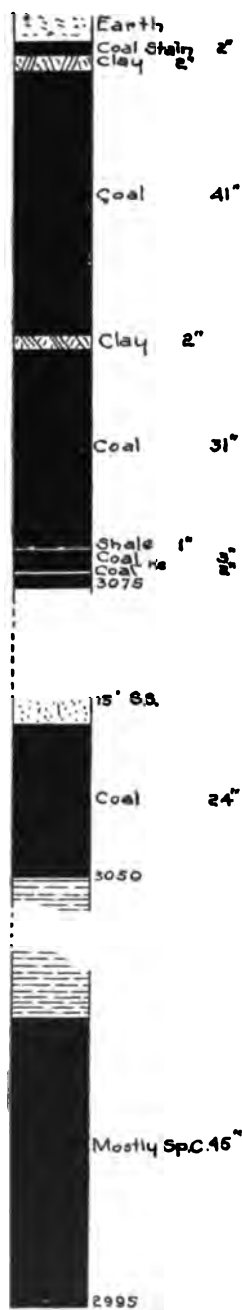
A few fragments of fossil limestone found on the left of the creek,

Fig. 114



Jasper N Holmes

Fig. 115



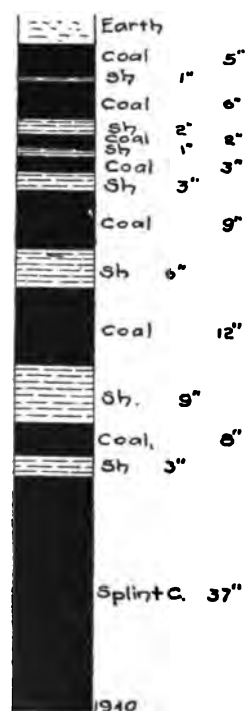
John B. Moore

$\frac{1}{4}$ mile below Mr. Moore's house, a mile or more up and $\frac{3}{4}$ miles from the head of the creek, show the interval from it to the High Splint bed to be about 300 feet.

Nearly opposite his house are the three upper coals of the section, reproduced in figure 115, the Cornett and High Splint beds with thinner coal intervening. It is altogether probable that the partings of the latter will disappear under cover, and that much of the coal will prove to be splint, as found elsewhere along the mountain. The opening was incomplete. The mountain top here is 600 to 700 feet above this coal.

On the left, $27\frac{7}{8}$ miles up Clover fork, 25 ft. above it on the right of a small branch, the Leonard bed has been poorly opened with the section shown in figure 116. A lessening of partings should be expected under cover. Again this coal has been mistaken for the Keokee. My sample

Fig. 116



Keokee Coal
Jasper N. Holmes

Fig. 117

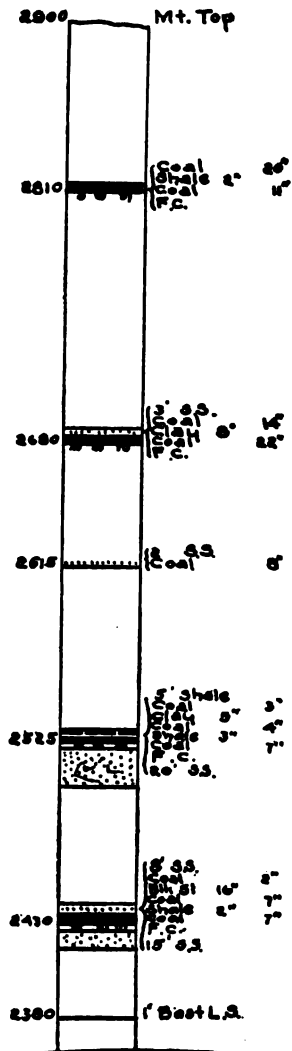
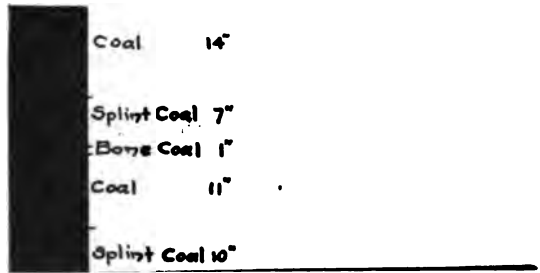


Fig. 118



of the upper 30 inches of the bottom seam, the rest of it being buried in mud where the sample was taken, was analyzed by R. W. Durrett with the results following:

LEONARD COAL.

Moisture.....	1.380
Volatile combustible matter.....	83.208
Fixed carbon.....	62.098
Ash.....	2.350
Sulphur.....	.563
	100.099

MARCUM BRANCH.

On the right, $28\frac{1}{4}$ miles up Clover fork; elevation of mouth, 1920.

A pretty thorough search for coals was made on this branch, with the result shown in figure 117.

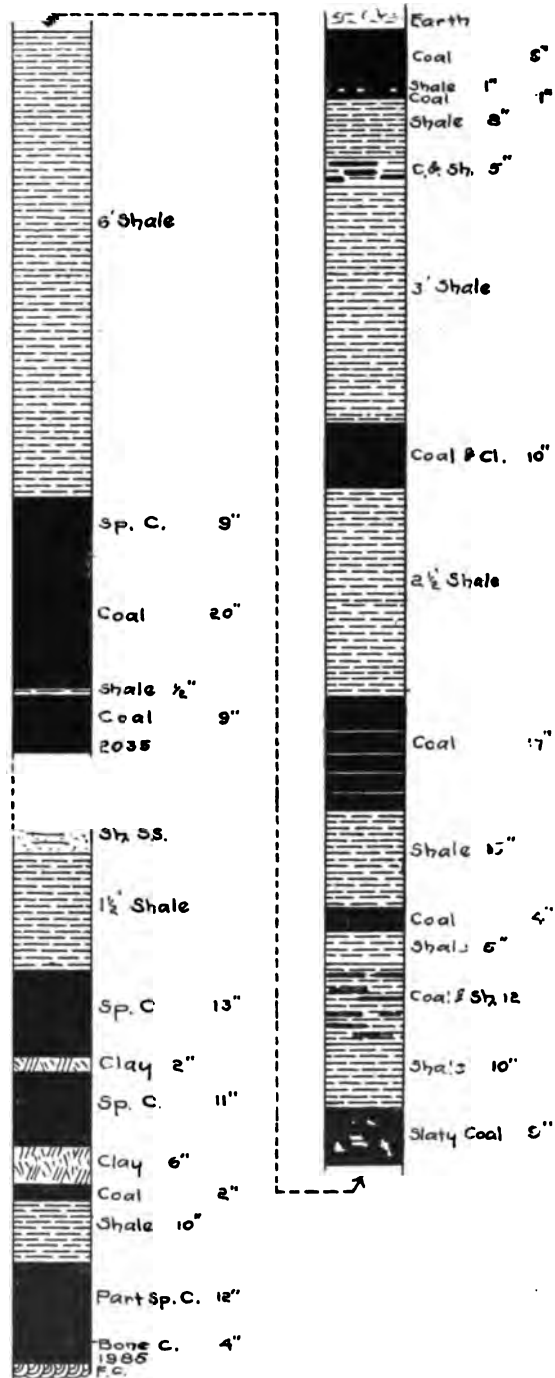
The coal at 2050, $\frac{1}{8}$ mile up the branch, is of the Keokee bed, the heavy sandstone below it showing that the Leonard bed is here far separated from it. The mixture of coal and shale in the upper bench led to carrying the opening under cover, but without favorable result.

The Low Splint bed, at elevation 2290, $\frac{1}{4}$ mile farther up the branch, is a far more promising bed for this vicinity. Its bed section is given in figure 118. With nearly 600 feet of covering here its area is ample for working.

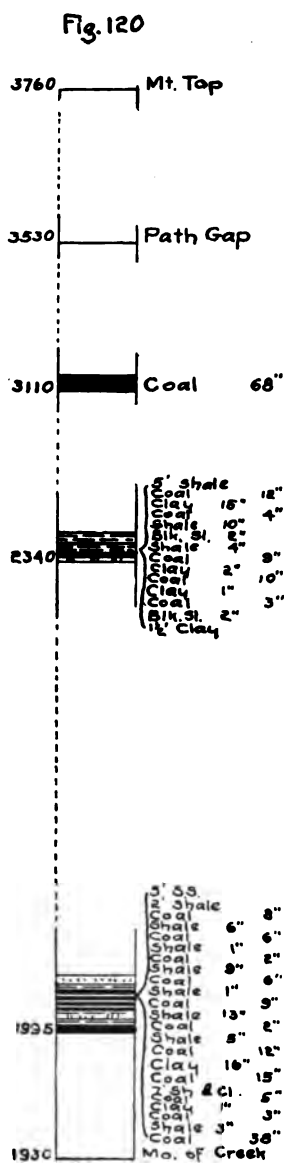
The Dean coal is perhaps that found at 2680, but it must be a long time before such coal in its small area can be profitably worked.

The two coals of figure 119 were opened, one above the other back of the Galloway house, $28\frac{1}{2}$ miles up Clover fork on the right, above Haupt's branch.

Fig. 119



Galloway's Keekee & Leonard Coals.



Section on Huff's Cr.

The lower one, 60 feet above the fork, is of the Leonard bed. Besides the partings shown the 11-inch seam has three knife-edge partings, and the whole section is unfavorable.

The coal at elevation 2035, of the Keokee bed, is in better condition and will doubtless be worked when available, though the 20-inch seam has two knife-edge partings. The many coal seams above the 6-foot parting are comparable with those over the same bed in Steep Hollow branch (15 $\frac{5}{8}$ miles up Clover fork) though there is 25 feet of sandstone in addition separating them from the main bed.

HUFF'S CREEK.

On the left, 28 $\frac{7}{8}$ miles up Clover fork; elevation of mouth, 1930.

Figure 120 shows the coals found on this stream. On the right, $\frac{1}{8}$ mile up the creek, on the Milton Huff, or Wm. C. Winn, tract, was opened the lower coal of figure 120. Its resemblance to the higher coal of figure 119 serves for its nearly positive identification as of the Keokee bed. Farther east that part of the bed above the thick parting disappears.

The lower, or workable, part of the bed is repeated in figure 121, showing the band of splint coal near

Fig. 122



Huff's Creek
High Splint Coal.

the top, found often as a characteristic of the bed, and especially so farther up Clover fork and in the Keokee mines. My sample of this 46 inches of coal, analyzed by R. W. Durrett, gave the following results:

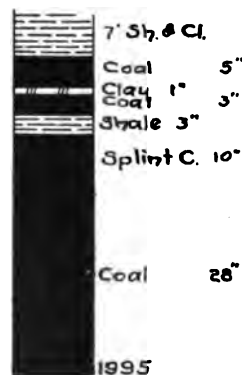
KEOKEE BED.

Moisture.....	1.35
Volatile matter.....	33.90
Fixed carbon.....	58.93
Ash.....	5.28
Sulphur.....	0.584
	100.044

The second coal of the section appears to lie between the Low Splint and the Dean beds, and is believed to be of no importance.

The High Splint coal at the top of the section, shown on a larger scale in figure 122, was opened on the right of the creek, $\frac{3}{4}$ mile from its head. It was not in condition for its quality to be determined, but its covering is shown to be quite sufficient to afford workable area.

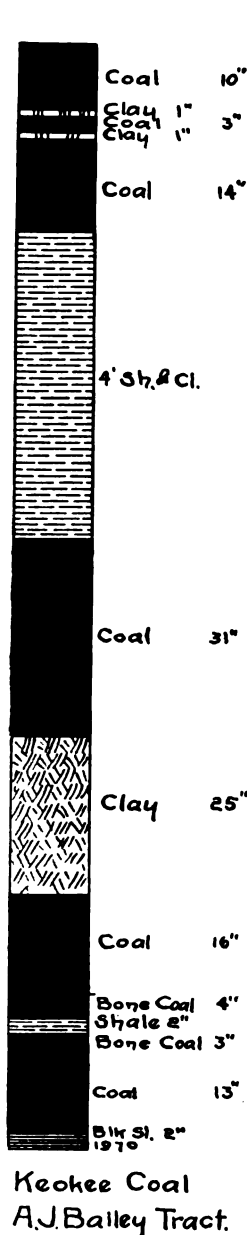
Fig. 121



Keokee Coal
Wm. C. Winch

On the right of Clover fork, opposite the mouth of Huff's creek, the upper part of the Keokee bed was opened, 60 feet above the creek, at elevation 1995, with 10 feet of shaly sandstone covering, and again on the left of the fork, at the road, $29\frac{1}{4}$ miles up, elevation 1985, with the following sections:

Fig. 123



	On Left Inches	On Right Inches
Coal.....	6	7
Parting.....	1/2	1
Coal.....	3	6
Parting.....	1/2	4
Coal.....	13	11
Parting.....	8	3
Coal.....	1	1
Parting.....	36±	17
Coal.....	24	16
Sandy bone C.		2

On the right of the fork, 5 feet above it, at 29½ miles, the whole bed was opened with the results given in figure 123, the 31-inch coal of the figure corresponding with the 16- and 24-inch seams given above. Though the bottom division, with its 7 inches of bone, is not attractive in appearance here, it will probably improve underground, and become well worth working, while the rest of the bed will diminish.

The Low Splint coal shown in figure 124 was found opposite and just below the mouth of Lauder creek. Its elevation is given with some uncertainty, but the bench of the coal is clearly defined at about that height.

LAUDER CREEK.

On the left, 30 miles up Clover fork; elevation of mouth, 2000.

Fig. 124



Figure 125 shows the lower coals found on this creek.

The Keokee coal at the bottom, opened on the right, at creek level, $\frac{1}{8}$ mile up, is given in detail in figure 126. The coals at elevations, 2195 and 2205, opened on the left, $\frac{1}{4}$ mile up, appear to be continuous from here to their disappearance below water level farther up Clover fork, and may easily be mistaken for the Low Splint bed, but they have not been found workable.

Fig. 125

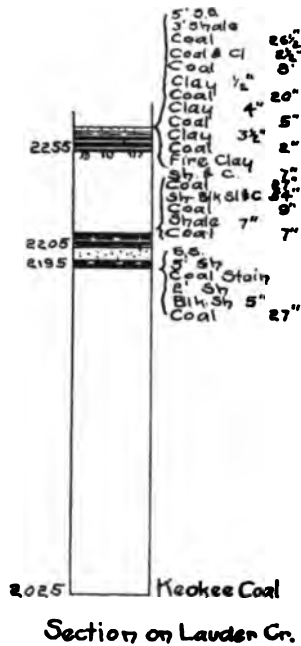


Fig. 126

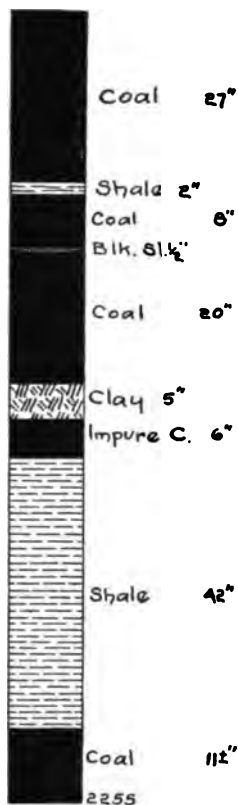


The Low Splint bed is given in figure 125 as first found by McCreath and D'Invilliers, whose sample of the upper three seams of coal, with $\frac{1}{2}$ inch clay parting included, yielded them the following results:

LOW SPLINT COAL.	
Moisture.....	5.012
Volatile matter.....	35.548
Fixed carbon.....	52.002
Ash (cream color).....	6.785
Sulphur.....	.653

100.00

Fig. 127



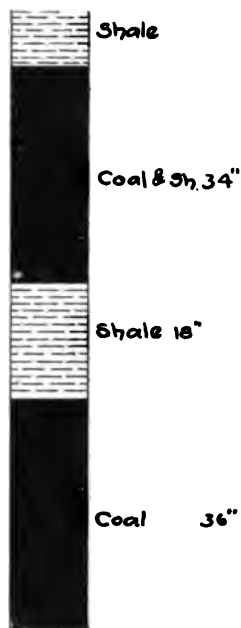
Low Splnt Coal
Wm. Huff

"The bed was merely faced for this examination, and was hardly in proper condition for sampling."

My latest measure of the bed is given in figure 127. The opening was still not under roof, but had been extended downward.

The coal of figure 128, opened for the Survey, near the head of the creek, is given as reported. It is supposed to be of the Cornett bed, but its elevation was not obtained, and there are no outcrops of coal or sandstones in the vicinity to guide in correlation. Farther east the Cornett bed is inconspicuous.

Fig. 128



Cornett Coal
Lauder Creek.

BUCK HOLLOW.

On the right, $30\frac{3}{8}$ miles up Clover fork, elevation of mouth, 2035.

The Keokee coal is opened on the left, $\frac{1}{8}$ mile up this branch, with the bed section of figure 129.

Fig. 129

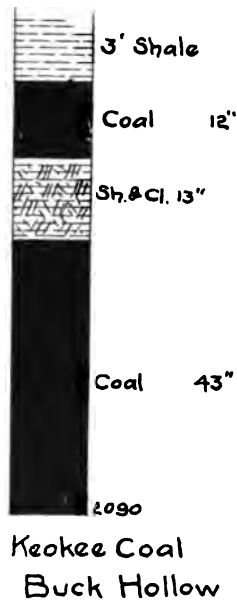


Fig. 130

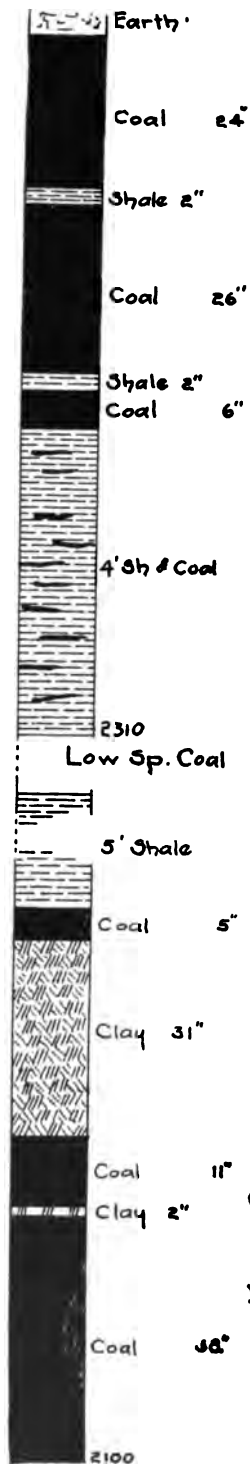
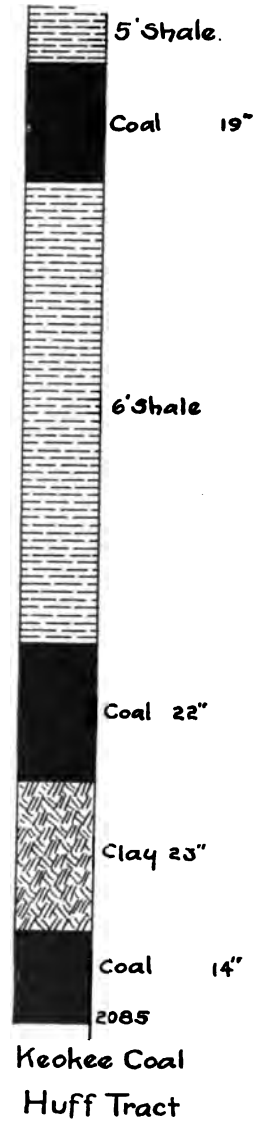


Fig. 131

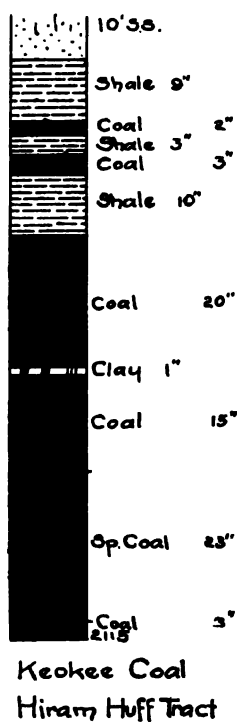


JACOB'S CREEK.

On the left, $30\frac{1}{2}$ miles up Clover fork, elevation of mouth, 2050.

Figure 130 gives the Keokee coal as found in the point of the hill at the mouth of the branch and the Low Splint coal $\frac{1}{4}$ mile up the branch. The latter was imperfectly opened and the measures are approximate only. Above the coal was 3 feet of earth, then 2 feet of shale under sandstone.

Fig. 132



On the left, $30\frac{5}{8}$ miles up Clover fork, 20 feet above it, the Keokee coal has the section of figure 131. Opposite this, on the right of Clover fork, Austin Scott tract, the middle seam of this coal is reduced to 20 inches, and the top seam appears to be wanting.

In front of Hiram Huff's house, 40 feet above Clover fork, the same bed gives the section of figure 132.

LITTLE TRACE BRANCH.

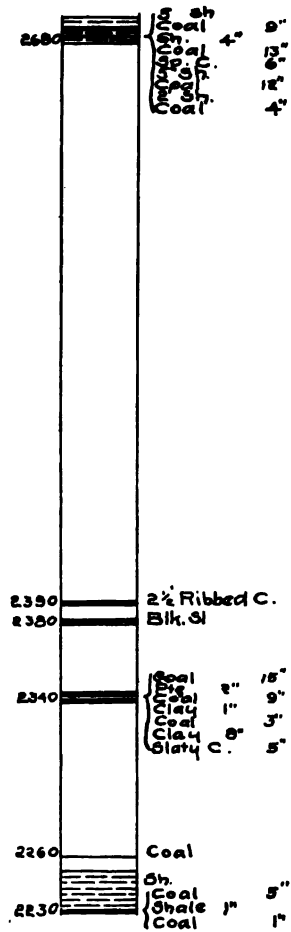
On the right, 31 miles up Clover fork, elevation of mouth, 2095.

Figure 133 gives coals found in Lynn Cove, a small branch on the right of Little Trace, $\frac{1}{4}$ mile up it. The Keokee coal is about at elevation 2170, making the ribbed coal and shale at 2390 probably the Low Splint bed. It lies on a prominent bench, as is frequently the case with that bed, but the close proximity of other coal makes identification uncertain.

The upper bed of the section is perhaps the Dean coal, but, again, without its characteristic parting, it is open to question.

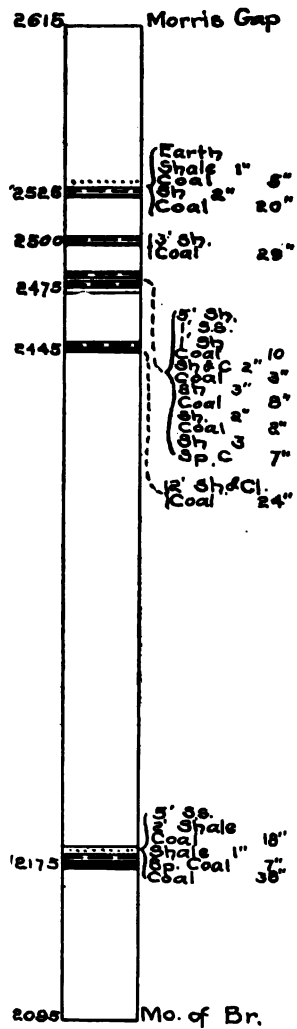
The section of figure 133 was taken approximately along the line of strike of strata, but that of figure 134

Fig. 133



Lynn Cove Section

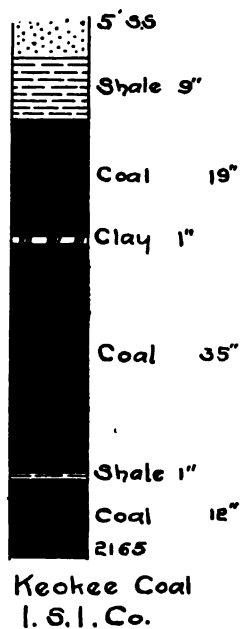
Fig. 134

Section on
Little Trace Br.

was not, showing by comparison a rapid rise in going up the branch, the Keokee coal near the bottom having an interval above it to the Low Splint bed, the upper coal of the figure, of only about 250 feet. The group of four coals near the top, however, were opened so near one another that the dip has no appreciable effect in the section.

The Keokee coal is exposed on the right at water level, $\frac{3}{8}$ mile up the branch, on the Blair heirs tract, now Pardee, where were obtained the measures given it in the section. With nearly the same measures by Mr. Thruston for the Survey, and by Messrs. McCreath and D'Invilliers, it was sampled by them, and the following analyses were obtained by Dr. R. Peter.

Fig. 135

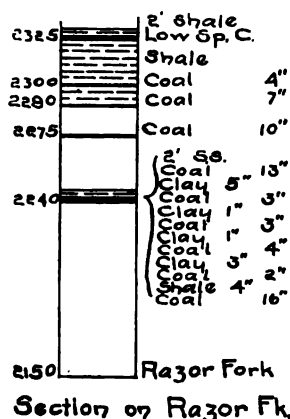


KEOKEE COAL.		No. 2869	M'C.
Moisture.....	1.40		2.234
Volatile combustible matter.....	32.00		35.571
Fixed carbon.....	62.30		58.016
Ash (light brown).....	4.30		3.430
	100.00		
Sulphur.....	0.712		.749
			100.000
Coke		Dense spongy.	

No. 2869. "Sample mostly in a much crumbled condition."

A later opening on the left, by road, between Lynn cove and the above, gave the bed-section of figure 135. The preceding opening and all of the following to be noted, on Razor and Clover forks, are on land of the Interstate Investment Company of Louisville, through whose courtesy the information is published here.

Fig. 136.

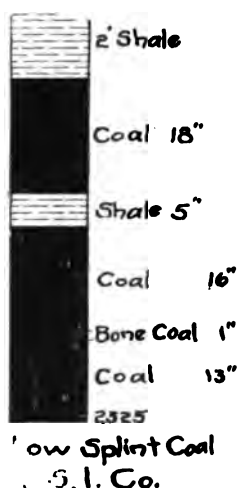


RAZOR FORK.

On the left, 31 miles up Clover fork, elevation of mouth 2100.

For a general view of coals of this vicinity see the longitudinal section, figure 4.

Fig. 137



With the northwest dip of strata the Keokee bed soon goes below drainage on this stream, and at the point where the section of figure 136 was taken, on the right, $\frac{5}{8}$ miles up Razor fork, is about 75 feet below drainage. Only the Low Splint bed and coals immediately below it are shown in this figure. The former is shown on larger scale in figure 137, as developed in a 7-yard entry.

In a cliff on the right, at water level a mile up, elevation 2270, is a fine display of fossil shales in 10 feet of shale, which seems to have no counterpart elsewhere.

Figure 138 is a continuation of the section of figure 136, the bottom coal of the former being the Low Splint. It was taken on the right of Razor fork, $1\frac{1}{8}$ miles up it, working up the pitch of strata, but in a drain so steep that the pitch has little effect on the section.

The Low Splint bed is shown in the figure with average thickness, given, and figure 139 gives limiting thickness of varying seams, one of which increases from 1 inch to five feet in an exposure of some 20 yards length.

Of the many beds of coal exposed here above the Low Splint, none are recognized as workable, excepting, possibly, that at elevation 2700, which has in its upper parting a dark brown clay under light brown. Such change of shade is not uncommon in the Dean parting, but here there is no indication of its flinty character, by which the bed can be certainly correlated. If it is the Dean a thickening of strata between it and the Low Splint

Fig. 138

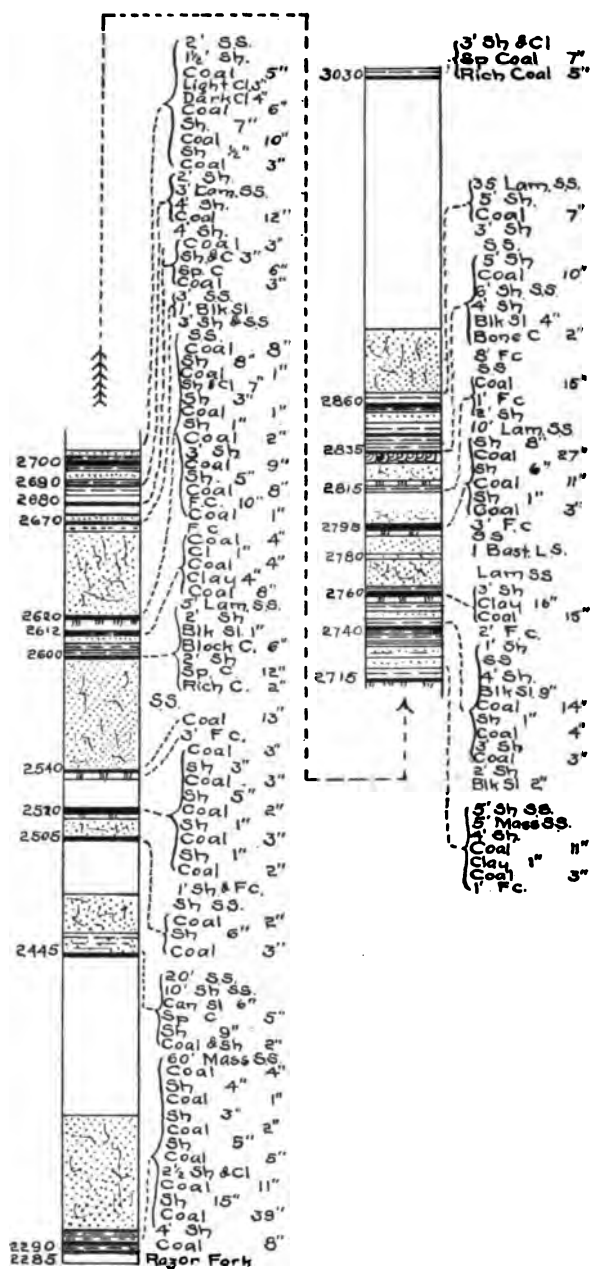
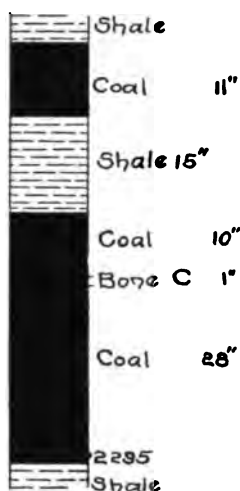


Fig. 139



Part of Low
Splint Coal

has occurred, from about 300 feet on Child's creek to 400 feet here, which is probably the case.

The coal at the top of the section is of an unnamed bed which increases in thickness in going up Razor fork (along Middle ridge) for nearly a mile until where 35 feet above drainage it attains the bed-section shown in the bottom coal of figure 141. But it diminishes again, before going under Razor fork, to the bed-section at elevation 3070 in figure 140. Figure 140 represents the section on the right of Razor fork, $2\frac{1}{8}$ miles up it, from its ford to the High Splint coal, about 80 feet below the summit here of Middle ridge.

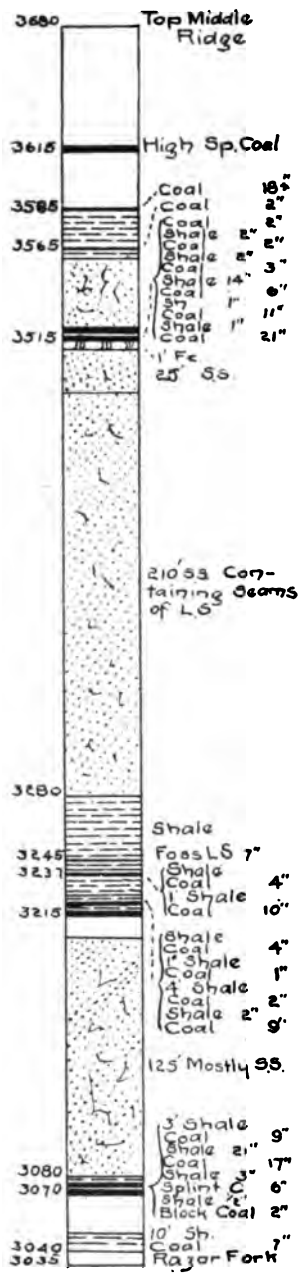
The coal at elevation 3215 appears to represent the Limestone coal, though unusually near to the fossil limestone at 3245. This latter is here but 7 inches thick, very shaly and imbedded in thick shale. Several thin limestone beds, apparently without fossils, occur above it in the laminated sandstones up to 3490

A thorough search was made here for the Cornett coal, and the 18-inch coal of elevation 3585 was the result. The full thickness is somewhat in excess of this measure, but, it was evident, only slightly so.

The High Splint coal was driven slightly under cover with the result shown in the top coal of figure 141. The proportion of splint coal was much increased from that found on first opening, and farther advance underground may develop more, but, in general, the surface openings on the heads of Clover fork, Clover Lick and Big Looney creeks indicate the lower half of the bed splint coal.

The dip in this vicinity is northwest, across Razor fork, about 4 per cent., probably the heaviest of any on Clover fork waters.

Fig. 140



Section on Razor Fk.

Fig 141



Main Coals of Fig 140.

Fig. 142



Fig. 143.



High Splint Coal.

Nim Hollow.—

On the left, $1\frac{1}{2}$ miles up Razor fork. Plate III. gives the view looking north up Nim Hollow from the side of Middle ridge.

On the left of the left branch of this hollow the High Splint coal is 69 inches thick, as shown in figure 142. On the right, a half mile up, it is 72 inches thick and a mile up 66 inches, both without parting.

On the right of the head of Nim Hollow, at the butt of Hall's spear, is the highest point of land in Kentucky, elevation about 4200 feet, and, with correction made for dip, about 750 feet above the High Splint coal.

On the right, 3 miles up Razor fork is a 4-yard entry into the High Splint coal giving 74 inches, as in figure 143. This is exceptional in being all splint coal, but no other entry on the bed has been carried so far underground.

Following is an analysis, No. 1, by Dr. R. Peter, of my outcrop sample of this coal. The effect of including extraneous matter in the sample is shown in the greater amount of ash resulting as compared with the clean coal of the later analyses by the U. S. Geological Survey. The lesser moisture of Dr. R. Peter's analysis is attributed to air-drying before the analysis was undertaken, against which provision was made in the later analyses by putting the samples immediately into glass jars sealed.

As preliminary to a thorough test at St. Louis of the coal of this bed the U. S. Geological Survey analyzed two

BIGOR CLEARING COVE RIDGE.



LOOKING UP NIM HOLLOW FROM MIDDLE RIDGE.

YELLOW BUCK SPUR.

PL. III.

HALL'S SPUR.

samples from this opening, one, No. 2271, from the opening itself, probably about 5 yards underground, the other, No. 2270, of selected weathered coal from the ravine below it—the waste from the dump. Especial attention is called to the latter inasmuch as the coal shows an absolute gain in quality over that taken from the opening itself, although the weathering had been continuous at least since 1893, when a block of the coal was taken out for the Chicago Exposition, and possibly since my first work at the opening in 1891, about 13 years earlier, the coal having lain meantime more or less buried in the dump. It is not to be supposed that an actual improvement of the coal resulted from weathering, but, rather, that the coal analyzed was superior to the average of the bed, and as, at this opening, the coal is a nearly uniform splint throughout, the deterioration in its long exposure, if any, must have been almost infinitesimal. Following are the analyses as given in the preliminary report on St. Louis tests in 1905, page 123:

HIGH SPLINT COAL.	No. 1	No. 2271	No. 2270
Moisture.....	1.20	4.45	4.32
Volatile matter.....	34.20	36.27	36.04
Fixed carbon.....	59.10	56.05	57.36
Ash.....	5.50	3.23	2.28
	100.00	100.00	100.00
Sulphur.....	.659	.54	.48

The coal next below the High Splint, opened in the ravine under the entry, gave 34 inches of coal with 4- and 1-inch partings.

On the left, $3\frac{1}{8}$ miles up Razor fork, 5 feet above it, 70 inches of coal was obtained in an unfinished opening, elevation 3590.

The numerous openings on this fork and on opposite sides of the mountain from it indicate an average thickness of over 6 feet in this vicinity. Though a large proportion of the coal is near the outcrop the waste on that account will not be relatively heavy, because the bed is covered by thick conglomerate sandstone, often appearing in high cliffs, under which the coal has been well protected.

Fig. 144

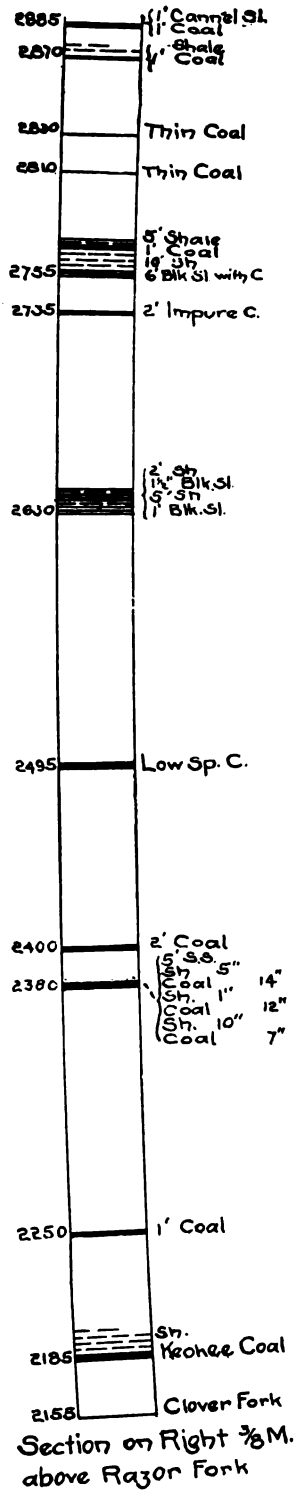
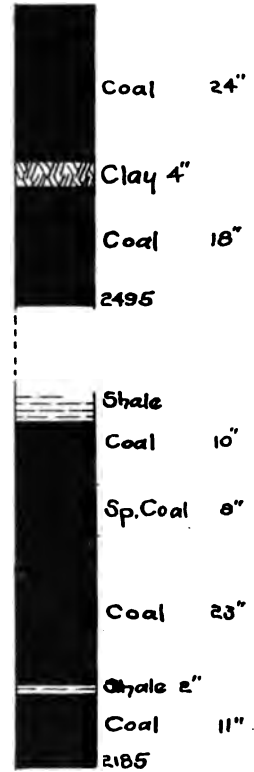
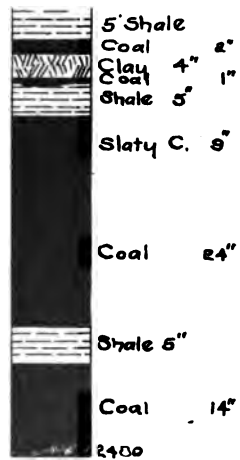


Fig. 145



Main Coals of Fig. 144

Fig. 146



J. Slomp Tract
Low Splint Coal

On the left, $31\frac{1}{4}$ miles up Clover fork, 10 feet above it, the Keokee bed is opened with 51 inches of coal and two knife-edge partings.

On the right $31\frac{3}{8}$ miles up Clover fork the section of figure 144 was taken. The dip here is N. 60 W. 3.2%, consequently the distance between the Keokee and Low Splint beds shows considerably more than the actual interval of about 250 feet and other intervals are more or less extended.

The lower coal of figure 145 is of the Keokee bed, as measured at the face of a 20-yard entry. A satisfactory test for coke, by burning in open rick, was made of this coal, but the marketing of coke from the same bed at Keokee, on the opposite side of Little Black mountain, overshadows this. The main Keokee entries are directed towards this one, and the Kentucky line will probably be crossed before this report is in print. The mines show an average of about 5 feet of coal, with one or two partings rarely exceeding 3 inches in thickness.

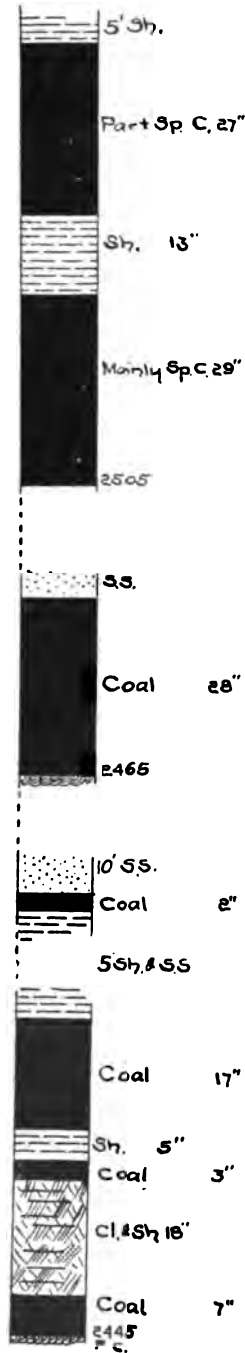
My samples of the coal and of two picked specimens of the open rick coke, were analyzed by Dr. R. Peter as follows:

KEOKEE BED.	Coal	Coke	Coke
Moisture.....	1.80	1.60	2.00
Volatile combustible matter.....	34.00	..	..
Fixed carbon.....	59.68	90.00	92.80
Ash.....	4.52	8.40	5.20
	100.00	100.00	100.00
Sulphur.....	.473	.257	.412
Color of ash.....	Light brownish gray.	Dark gray.	Light brownish gray.
Coke.....	Spongy.		

The upper coal of figure 145, the Low Splint, opened in a 10-yard entry, gives a fine hard coal. Opposite, on the Virginia side of the mountain, the bed is nearly 5 feet thick, including a small parting, but on either side of that opening the coal diminishes and the parting increases.

Immediately above the point of the last section the Keokee bed disappears, finally, below drainage.

Fig 147



Section 1 1/2 M. above Razor

On the left at 32 miles, J. Slempt tract, the Low Splint bed has 40 inches of coal and 10 inches parting, and east of this opening, in the same hollow, the main parting reduced to about 5 inches, a somewhat variable section, of which 146 shows an average. The coal here shows a considerable amount of sulphur.

At the head of the same hollow is a cliff from elevation 3360 to 3460 having a few scattered pebbles in it, some coarse crystallized sand and streaks and lenses of coal. Farther east on Middle ridge pebbles show again in a sandstone with base at elevation 3495, and again in a sandstone at 3550 to 3610, the latter being near the High Splint opening at elevation 3615. (Figure 140). With about 60 feet of conglomerate rock over the High Splint bed this gives a range of pebble deposition through a thickness of about 300 feet of strata.

In a branch on the right, 32 1/2 miles up Clover fork, were found the

Fig 148



coals of figure 147, the upper one being the Low Splint bed. The opening was carried under roof, so that the parting bid fair to be continuously heavy. It was found, also, opposite, on the south side of the mountain.

An incomplete opening on the right, 33 miles up Clover fork, 30 feet above it, elevation 2540, gave 4 feet of coal with more coming in. It may be assumed that the bed, though seriously injured by its parting, has an extensive working area here.

On the left, 34 miles up Clover fork, in a rockhouse in Rich cove, the High Splint bed has the section of figure 148. My sample of this coal was analyzed by Dr. R. Peter with the following results:

HIGH SPLINT COAL.

Moisture.....	2.40
Volatile combustible matter.....	33.60
Fixed carbon.....	59.40
Ash.....	4.60
	100.00
Sulphur.....	.769
Color of coke.....	Light
	brownish gray.
Coke.....	Dense spongy.
Specific gravity.....	

On the left $34\frac{1}{4}$ miles up Clover fork the same bed showed 5 feet of coal and rising in an unfinished opening. It is about 60 feet below the gap to Looney creek at the head of Clover fork, but soon runs out on the right. This is the only place on Little Black mountain east of Rockhouse creek, excepting a few acres in the top of High Butte (east of Low gap) where the mountain is high enough to catch the coal. It is essentially a Big Black mountain bed.

The condition of the coals in the Upper Crab Orchard, Virginia (including the North fork drainage of Keokee and east of it) will affect largely the development of the coals of Clover fork near its head, and especially is this true of the beds which are below drainage on the Clover fork side.

The lowest bed of the series, workable in the Upper Crab Orchard, is that assumed to be one of the Dorchester

beds, found along Wells branch with about 4 feet of coal. It lies too deep on Clover fork to be of present commercial importance there.

The Imboden bed, with about 5 feet of coal on the head of Crab Orchard creek, being nearly 500 feet below Clover fork at the mouth of Razor, can probably be worked to best advantage in that vicinity from Virginia, but farther development is necessary to prove it of value on the Kentucky side. The bed is worthless where coming above drainage near Harlan, and, generally, along the northern face of Big Black mountain.

Excellent thin flagstones have been taken from about 70 feet under the Harlan coal, from the Alma Hyatt place, and used for chimneys, grave-stones, etc. Its occurrence here led to finding similar stone in various places on Clover and Poor forks at about the same distance below the Harlan coal.

The Harlan (Wilson) bed is extremely variable in the Crab Orchard, both in its amount of coal, and in its partings. It probably averages over 5 feet of workable coal. At the Keokee mine it has $5\frac{1}{2}$ to $6\frac{1}{2}$ feet of coal with parting of 1 to 15 inches. Though making an otherwise remarkably fine coke, its sulphur led to the abandonment of the mine for the present, in favor of the purer Keokee coal.

Following are analyses of the Harlan coal, A and B from outcrop openings on the A. C. Morris and Wilson places, respectively, (now Inter-State Investment Co.) by McCreath and D'Inwilliers, and C of average results from samples taken foot by foot from top to bottom of the Keokee (Wilson) mine as reported by the Keokee Coal and Coke Co. Analysis of the coke for the same company is given under Column D.

HARLAN BED.	A	B	C	D
Moisture.....	2.692	2.692	..	..
Volatile matter.....	36.933	38.723	38.91	2.65
Fixed carbon.....	55.233	51.847	53.00	83.54
Ash.....	4.195	4.730	6.56	13.81
			98.47	100.00
Sulphur.....	.947	2.008	2.036	2.11
	100.000	100.000		

The results of A and B, of outcrop coal, are remarkably similar to those of the mine coal under C, considering that the former coal is confessedly inferior to the latter, and especially for coking.

Harlan coal from the close vicinity of the Wilson mine at Keokee was tested at St. Louis by the U. S. Geological Survey. Samples obtained from about 10 yards in yielded the following results, No. 2246 being of the entire seam, 2268, of the lower bench, 2269, of the upper bench, and 2420 being of a car sample.

HARLAN COAL.	No. 2246	No. 2268	No. 2269	No. 2420
Air-drying loss.....	2.60	4.20	4.40	2.40
Moisture.....	4.72	5.69	6.55	4.06
Volatile matter.....	34.21	34.43	33.51	34.93
Fixed carbon.....	56.44	51.77	55.54	56.28
Ash.....	4.63	8.11	4.40	4.73
	100.00	100.00	100.00	100.00
Sulphur.....	2.55	2.31	.80	1.20

Tests of the coal were made as to its quality for steam-making, for producer-gas, and for coking, in all of which it showed excellent qualities; except for its high sulphur, it is a pre-eminently good coking coal, "hard and heavy." The sulphur has led to the present abandonment of the mine in favor of the purer Keokee coal, but, as much of the sulphur occurs as heavy pyrites, washing would doubtless to a large extent overcome this defect.

The following analyses of the coke are given by the U. S. Survey:

HARLAN COKE.					
Moisture.....	1.52	1.23	0.21	0.30	0.20
Volatile matter.....	.99	1.67	.89	1.16	.80
Fixed carbon.....	89.20	89.24	90.99	90.85	91.52
Ash.....	8.29	7.86	7.91	7.69	7.48
	100.00	100.00	100.00	100.00	100.00
Sulphur.....	.88	.94	1.01	.97	1.02

Full details of the various tests are given in Bulletin No. 290, pages 186 to 189.

The Keokee coal is extensively mined at Keokee, and before this report is published Little Black mountain will be penetrated, it is expected, across the State line into Kentucky.

In the several miles of entries already open the coal seems nearly uniformly 5 to 5½ feet thick, with a parting generally of 2 to 4 inches, though in one short entry nearly 2 feet thick.

Analyses of the mine coal, furnished by the Keokee Coal & Coke Co., are as follows; the last column being of screened and crushed coal taken from the belt conveying to bin.

KEOKEE COAL.				
Volatile matter.....	38.96	38.32	38.90	33.21
Fixed carbon.....	55.98	57.25	58.30	57.67
Ash.....	5.25	4.38	2.80	9.12
	100.19	99.95	100.00	100.00
Sulphur.....	.72	.74	.721	.843

Following in column A is the average of three analyses of 72-hour coke, in B of eight analyses of 48-hour coke, and in C of analyses of samples from the daily shipments through one month to one customer.

KEOKEE COKE.			
	A.	B.	C.
Volatile matter.....	2.35	1.83	4.39
Fixed carbon.....	86.08	86.88	83.38
Ash.....	11.07	11.26	12.26
	99.50	99.97	100.03
Sulphur	.625	.548	1.523

Phosphorus was determined in one instance in 48-hour coke, and found to be .0032 per cent.

The following report of results of tests by the Evansville (Ind.) Gas and Electric Co. was also furnished by the company:

Test of Keokee (Egg) Coal.

(Duration of test: 7:00 a. m., March 22, to 7:00 a. m., March 24, '09.)

Coal carbonized.....	115.8 tons.
Yield of gas per lb. coal (corrected).....	4.99 cu. ft.
Yield of coke.....	65.8 per cent.
Candle power (Argand burner No. 1)	15.1
Candle power (Metropolitan No. 2).....	17.0
Bench fuel per ton coal carbonized.....	430 lbs.
Average charge per retort.....	352 lbs.
H ₂ S at outlet of secondary condenser.....	1.1 per cent.
H ₂ S at inlet to purifiers.....	0.77 per cent.
Ash from coke in salamander test.....	12.7 per cent.

Description of Tar.—Could see no difference in the tar from the Pittsburgh.

Standpipes and Hydraulic Mains.—Have had no trouble with choked standpipes or pitch in hydraulic mains.

Salamander Test.—189 lbs. coke burned to 24 lbs. of ash, or 12.7 per cent. ash.

Coke in Water Gas Generator.—It is very good fuel for gas making and compares favorably with the Roda or Pittsburgh coke. Clinkers are not bad and not much dead stuff is formed.

The U. S. Geological Survey tested coal at St. Louis from the Keokee bed, 25 yards underground, in what is now the No. 2 McConnell mine. These tests are given in detail in Bulletin No. 290, pages 189 to 193, and show the coal to stand among the best for steaming and producer-gas, while making an excellent coke. The coking test is confirmed in its commercial production, demand for the coke, as well as coal, having been continuous during the present period of depression. Its only defect appears to be in a tendency to brittleness.

The Low Splint bed in the Crab Orchard as on the north of Little Black mountain runs irregularly from an unworkable bed up to 5 feet of nearly clean coal, especially valuable for steaming.

Beds above the Low Splint are not workable here.

POOR FORK.

In the following description of Poor fork coals distances along the fork are generally derived from U. S. Geological Survey maps and from mile posts. Elevations for the first 10 miles are from levels of the same Survey, and for the remainder from its topographical maps and from barometric observations taken when the coals were examined.

Mr. J. H. Gardner, as assistant, reported many of the coals through Harlan county, and such will be designated by the letter G, in parenthesis.



Harlan Coal, AL. Coldiron.

On the right, $\frac{1}{2}$ mile up Poor fork, Mr. Coldiron has an entry into the Harlan bed, opened for local use, 450 feet above the fork, its bed-section shown in figure 149. (G.)

This entry is somewhat higher than are those opposite it on Clover fork, Big Black mountain, indicating a synclinal axis somewhere within the mountain. It is possible that this is a split from what appears to be the main axis crossing Little Black mountain to Martins fork.

On the right, $\frac{5}{8}$ mile up Poor fork, 10 feet above it, is coal with the following section:

10'	Massive sandstone.	In.
3'	Shale.	
	Impure semi-cannel coal	6
	Coal	13 El. 1180

The southeast dip here is 27 degrees, but this continues only a very short distance into the hill, so that the coal is likely to be the same as that found at Clover fork level in Harlan, believed to be the Imboden.

SPICEWOOD HOLLOW (G.)

On the right, one mile up Poor fork; elevation of mouth, 1190.



Harlan Coal, Lloyd Nolan.

In this hollow, near its mouth 75 feet above it, a 30-inch coal on sandstone is noted with a dip of 27 degrees. The dip being 15 degrees at $\frac{1}{8}$ mile up this coal must lie deep, and is unidentified.

At $\frac{1}{2}$ mile up, the dip is still southeast, but apparently slight, here the coal of figure 150 is opened.

COLONEL'S BRANCH. (G.)

On the right, $1\frac{1}{2}$ miles up Poor fork; elevation of mouth, 1195.

Figure 151 shows the coals found on this branch, and figure 152 the Harlan coal on enlarged scale. That and the coal next below the Harlan were found approximately on the line of strike of strata so that the interval shown is nearly correct. At both points, $\frac{1}{2}$ mile up the branch, the dip is noted as 4 degrees.

Making allowance for dip the highest bed of the section would appear to be of the Keokee, but the resemblance it bears to the Hensley branch, Clover fork, Leonard coal makes it probably of that bed.

On the right, 2 miles up Poor fork, 440 feet above it, $\frac{1}{2}$ mile up a branch, is the Harlan coal of figure 151, (G) again with a southeast dip of 4 degrees. Coal from this entry is used for an incline bringing timber over Pine mountain.

GAP BRANCH. (G.)

On the right, 3 miles up Poor fork; elevation of mouth, 1215.

At $\frac{3}{4}$ mile up this branch the Harlan coal has the section of figure 154, the dip being 6 degrees.

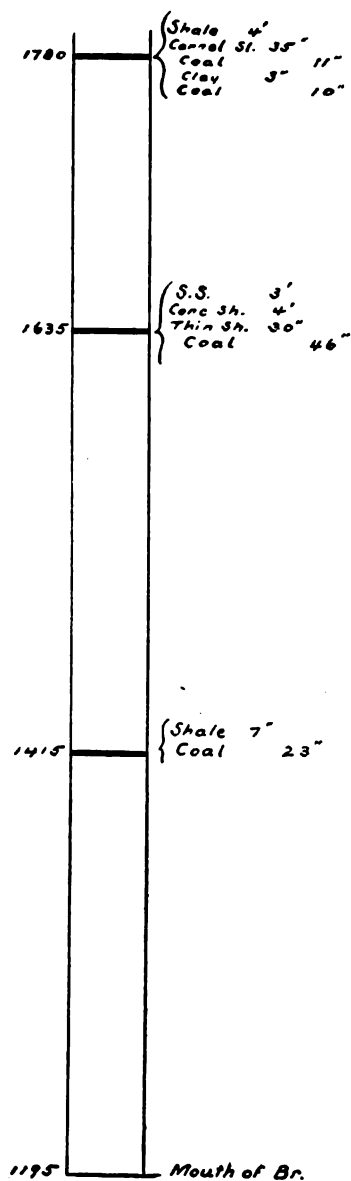
ENGLISH CREEK.

On the right, $3\frac{1}{2}$ miles up Poor fork; elevation of mouth, 1215.

Little Lick Branch.—On the right, $\frac{1}{4}$ mile up English creek.

Coals on this branch are as given by the U. S. Geological Survey, Bulletin No. 49. The lower coal of figure

Fig. 151.



Section on Colonel's Br.

Fig. 153.



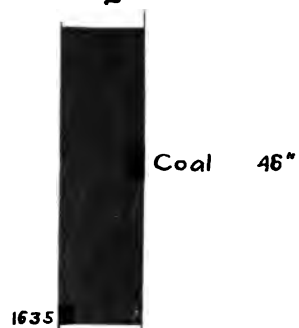
Harlan Coal, Thomas Jones

Fig. 154.



Harlan Coal, Gap Cr.

Fig. 152.



Harlan Coal, Ben Sargent.



155, opened $\frac{1}{4}$ mile up the branch, was recognized as of the Harlan bed, but its elevation was not given, nor was that of the Keokee (Kellioka) coal above it.

A 26-inch coal, enclosed in sandstone was also found, about 350 feet stratigraphically above the Harlan coal, and doubtfully referred to the Low Splint (Creech) bed, but it is more likely to be one of the generally thinner beds lying close under the Low Splint. The interval from the Harlan coal to the Low Splint is probably here as elsewhere in this region, somewhat over 400 feet.

Fig. 156

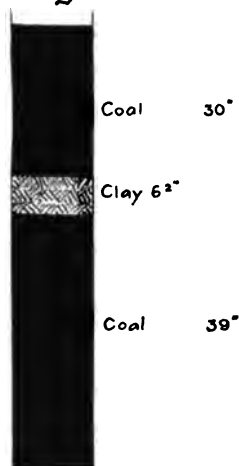
Harlan Coal, Silas Nolan.

From the same report is taken the following section of Nolans coal, opened on the right of Poor fork, a little above English creek:

Ft.	In.
	Sandstone.
8	Shale.
	Coal—thin streak.
	Parting..... $2\frac{1}{2}$ "
	Coal..... $1\frac{1}{4}$ "
	Parting..... $\frac{1}{4}$ "
	Coal..... 48"

On the right, 5 miles up Poor fork, 430 feet above it, Silas Nolan, has the coal of figure 156, (G.) the opening partly covered so that its measurement was not accurate.

Fig. 157.



Harlan Coal.

John Sargent, Canoe Hollow.

CANOE HOLLOW.

On the right, 5 1/2 miles up Poor fork—Kellioka post office opposite.

The U. S. Geological Survey reports in this hollow the coal of figure 157.

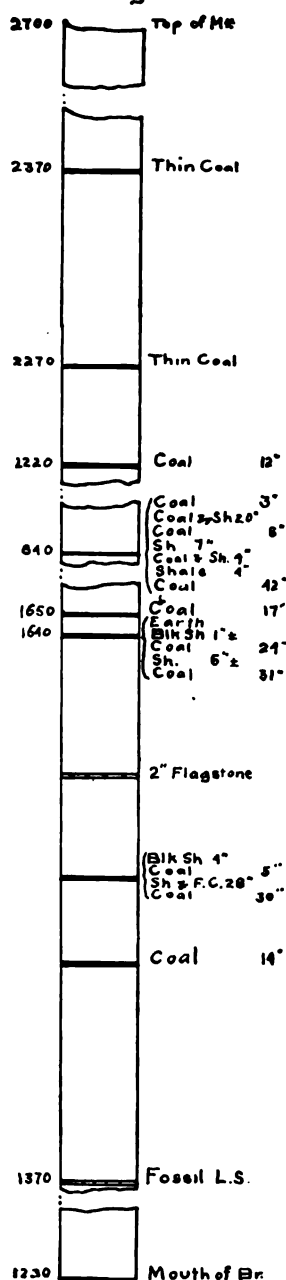
LONG BRANCH.

On the right, 6 1/2 miles up Poor fork; elevation of mouth, 1230.

The limestone shown near the the bottom of figure 158, found in the bed of the branch, like one high high up in the mountain, is abundantly supplied with fossil shells. Other exposures in the branches of Poor fork indicate a continuous bed, but it has received little attention.

The 30-inch coal next below the the Harlan bed appears to be the same as the 23-inch coal found on

Fig. 158



Section on Long Br.

Colonel's branch. It is likely to be of some importance when the Harlan bed is exhausted. Though but about half as thick on Clover fork it is nearly 3 feet thick farther up Poor fork.

The flagstone under the Harlan coal is about 2 feet thick, very thin bedded, similar to that noted at various points about 70 feet under the Harlan bed.

The Harlan coal, at elevation 1640, opened $\frac{1}{2}$ mile up the branch, with a dip, southeast, of 4 degrees, is given in figure 158 as measured by Mr. Gardner, and in figure 159 as given by the U. S. Geological Survey, Pro. Pap. 49, page 159. In plate XXV of the same report it is somewhat different.

At $\frac{3}{8}$ mile up, George E. Blanton's opening into the Keokee bed gave the U. S. Geological Survey the upper coal of figure 159.

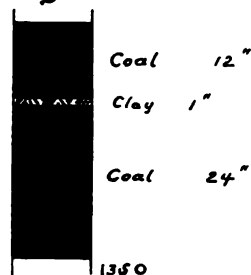
MILL BRANCH. (G.)

On the right, 8 miles up Poor fork; elevation of mouth, 1235.

The Harlan coal on this branch, is opened, $\frac{1}{4}$ mile up it, with about 52 inches of coal, as in figure 160, the south-east dip, 9 degrees.

The Keokee bed, figure 160, with dip not noted, probably slight, gives here a better section than appears elsewhere on Poor fork below Big Looney creek. It should be a decided encouragement to mining opposite on the south side of the mountain, in this vicinity.

Fig 161.



E. Sailor.

On the right, $9\frac{1}{2}$ miles up Poor fork, 15 feet above it, at elevation 1275, Nannie Lewis has an opening of some local renown having 12 inches of coal under 4 inches of cannel slate. (G.)

On the right, 11 miles up Poor fork, 70 feet above it, is the opening of figure 161. (G.) The heavy dip of

Fig. 159.

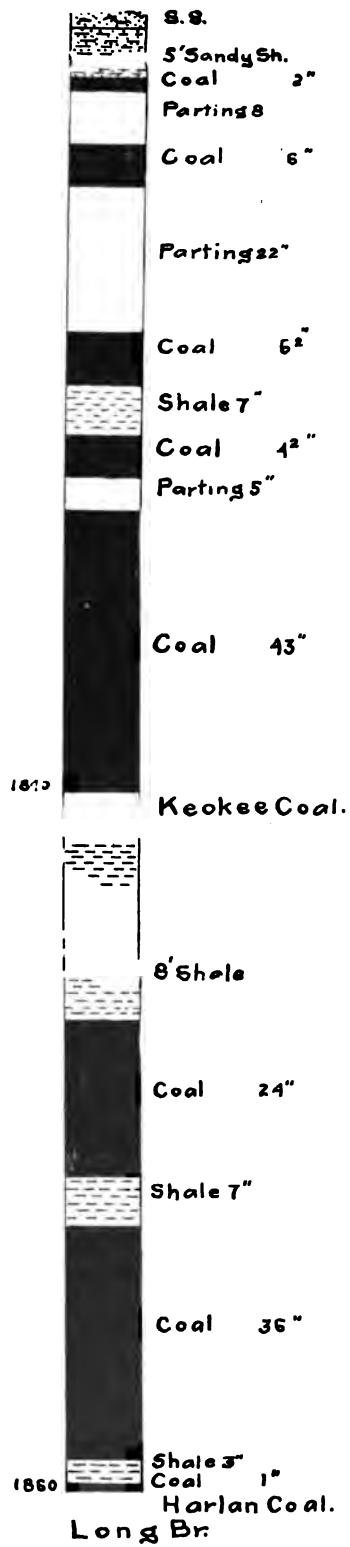
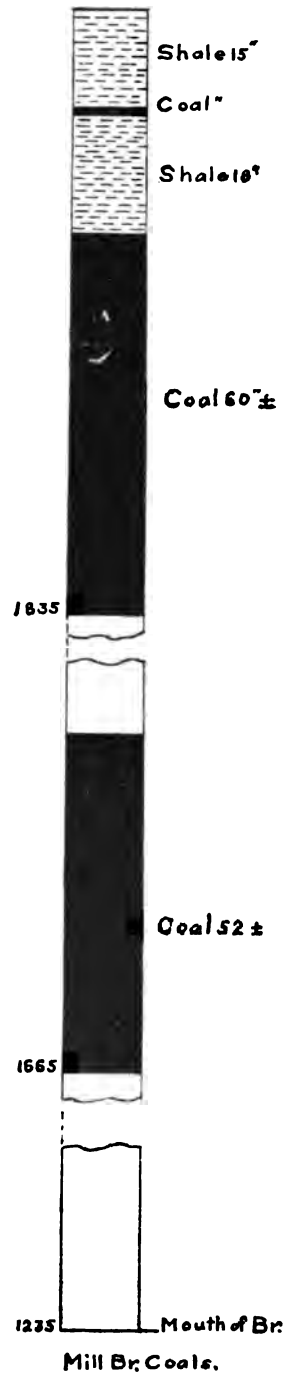


Fig. 160.



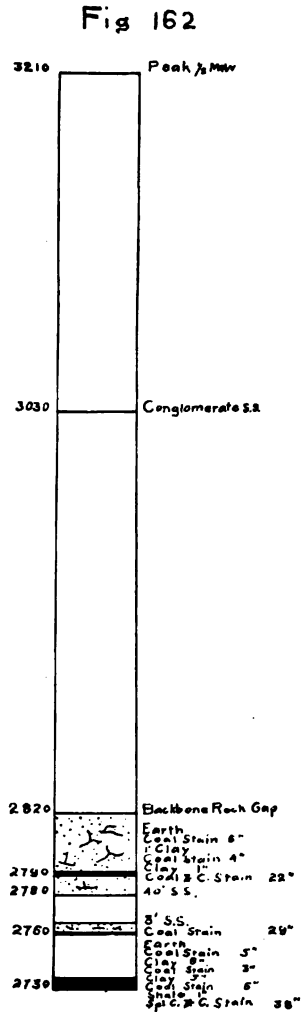
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strata here precludes correlation now, but the bed lies near the conglomerate on the face of Pine mountain.

About a mile west of Clover gap, at the head of a branch, say at $11\frac{1}{2}$ miles up Poor fork, the high coals of figure 162 were partly opened, that at elevation 2730 being of the Cornett bed and at 2790 of the High Splint. It is probable that with complete opening they would prove considerably better, especially the High Splint coal, but the labor involved was too great for the purpose of the Survey, even though this is the most westerly point on the north side of the mountain where the beds have been opened and the covering is sufficient to provide a workable area.

Backbone Rock gap, $\frac{1}{4}$ mile to the left of these openings, is peculiar in that the summit is here a wall of rock with sides nearly vertical 20 to 40 feet high, level on top for about 30 yards and but 2 to 5 feet wide. The High Splint coal must be directly under it.

On top of the mountain to the right of the coal openings is an outcropping of reddish brown, medium-size grain, conglomerate sandstone with pebbles up to $\frac{1}{4}$ inch diameter and not infrequent. It is about 250 feet above the High Splint bed and this is the only place known where they occur more than 70 feet above it, than that height above it having been found of fine grain.



Section $11\frac{1}{2}$ Miles up Poor Fk.

STRAIGHT BRANCH.

On the right, 12 miles up Poor fork; elevation of mouth, 1300. This branch is $\frac{1}{2}$ mile below that one heading at Clover gap.

For a general view of the coals of this vicinity, see the longitudinal section, figure 3.

Because the branch is nearly straight, flowing almost directly along the line of greatest dip, with strata much exposed, debouching in the Poor fork valley where very narrow, opposite exposure of what appears to be the top of the main conglomerate rock flanking Pine mountain, this place was selected for obtaining a rough estimate of thickness of strata from a known coal bed to that conglomerate.

For this purpose measurement was taken along the branch from Poor fork, about 100 yards from the base of Pine mountain, up Straight branch to the Leonard coal, its height having been obtained by barometer, noting the coals and dips as favorable places for so doing were passed. From these data figure 163 was drawn, in which it will be seen that there is a constantly decreasing amount of dip as the stream is ascended to the Leonard bed, above which it is slight. The Keokee bed being about on the same level on this branch and on Clover Gap branch, Clover fork, with dip toward the mountain from each outcrop, a synclinal axis must be within the mountain. Strata on both sides show something of this. The depression is probably slight.

By measurement of the intervals between strata on figure 163 the section of figure 164 was obtained, giving an approximate stratigraphic section, but the position of the River coal is not fixed with certainty because its opening is 100 yards below the branch and an apparent roll of strata makes it indefinite.

A check on these results was attempted by observation of the outcropping rocks, estimating their thicknesses and those of the perpendicular intervals between them, and figure 165 gives the result of this trial.

While the correspondence between the two is pretty close in the middle of the section, where outcrops were

plentiful, the wide variation at its extremities shows that there is possibility of considerable error in one or other of these methods unless great care is taken in using them. The discrepancy, however, in this case is not of moment, and the section of figure 164 may be assumed as the true section; from which it appears that there is a thickness of about 1275 feet between the Leonard coal and the top of the Pine mountain conglomerate, or 1065 feet from the Harlan bed to the conglomerate.

Figure 166 shows in detail the principal coals of this branch, including the "River" coal opened in several places 100 yards below the branch.

These latter openings show varying sections, due probably, to a small local roll, but that one given in the figure seems to be normal. The pitch of the bed, 25 to 30 degrees, though unfavorable for mining will not preclude it at some future time, and will lessen on entrance according to the dips of figure 163, carrying it over 1000 feet below the Harlan coal, and perhaps 500 feet below the mouth of Clover fork. It is, apparently, several hundred feet below the Dorchester coal, but a thickening of strata may have come from the uplifting of Pine mountain to make that difference. On the other hand, in the Upper Crab Orchard, on the North fork, $\frac{1}{4}$ mile below "John's bottom," is an uninvestigated coal 2 or 3 feet thick several hundred feet below the Dorchester bed. The bed is supposed to cross Poor fork near the mouth of Lick branch, with thick coal reported there, and farther east it is lost in Pine mountain.

Following is an analysis by Dr. A. M. Peter of my sample of coal taken from the face of an entry 1 yard in:

RIVER COAL.	Lab. No. 2696.
Moisture.....	5.92
Volatile combustible matter.....	32.95
Fixed carbon.....	56.66
Ash (reddish yellow).....	4.47
	100.00
Sulphur.....	.68
Phosphorus.....	.064
Coke.....	friable.
Specific Gravity.....	1.378

It is rather a dull-looking, soft coal slightly inclined to splint at the bottom, and of irregular cleavage.

Nothing was found by which to identify any of the coals up to the Leonard bed, and that only by its distance from the Keokee bed above it, for it is split up here beyond recognition and has no apparent value.

The Leonard bed, at elevation 1710, is also known by its relation to the Keokee.

The Keokee coal at elevation 1760 is recognized by its usual 3 to $3\frac{1}{2}$ feet of solid part-splint coal at bottom and numbers of thinner seams above, and by its relation to the higher coals and fossil limestone above it.

The section from here to the fossil limestone, taken by Mr. Gardner, shows the Low Splint bed thin and the Dean coal with nothing but its flint clay parting to distinguish it. The fossil limestone was found $\frac{1}{8}$ mile to the left of the line of section.

The Cornett coal, at elevation 2685, is unattractive here on account of its partings, as well as its height.

The High Splint bed, at elevation 2735, is little better as shown in the figure, but the opening was incomplete, and if finished the parting will, likely, be eliminated. The proportion of splint seems to be less here than found farther east. About half way from these openings to Clover gap coal of the same bed has been squeezed out from under a 30-foot cliff, at elevation 2760, and on the crest of the mountain at elevation 2800 a pit developed a 3-foot coal stain of the same bed, no doubt much reduced by weathering. It is almost under a 40-foot cliff to the west. Though this coal is 450 feet above Clover gap, it is still over 200 feet below the summit at the head of Straight branch, and its area west of the gap is quite sufficient for mining. At no other point on Big Black mountain is such a thickness of measures exposed, nor have so many of the principal coal beds been found.

TURKEY-PEN BRANCH.

On the right, $13\frac{1}{4}$ miles up Poor fork; elevation of mouth, 1328.

Mr. Thruston, in 1885 and 1887, made two more careful attempts than were the recent ones on Straight branch, to obtain the thicknesses of strata on this branch, by

measurements of horizontal distances and of dips. The two agree fairly well, better than expected with the differing readings of barometer and clinometer, and their results are averaged in figure 167, giving a total thickness of strata of 1435 feet in the first 485 feet height ascending the branch. The dip varies from 33 degrees, southeast, near the mouth of the branch to 6 degrees in the upper coal. The river coal of Straight branch is probably in, or very near to the bed of Poor fork, and the width of bottom land from Poor fork to the base of Pine mountain is probably about the same at each place. A comparison of these sections shows their similarity.

Examination of the Turkey-Pen section alone would indicate the coal at 1210 as of the Leonard bed, but the partings are small and in a nearby opening, figure 168, elevation 1655, are wanting, while more coal comes in on top, making a strong presumption that it is of the Keokee. With this as a starting point the following items are given of the Turkey-Pen coals, all derived from Thruston's notes. The correlations are mine.

The lower coals it is manifestly impossible to correlate with those in the southern borders of the field. That at 640 is given, as first measured, in figure 168, elevation 1475. A later measure gives the bed 27 inches without parting, the bed doubtless seen at different points.

The 32 inches of fine hard coal, at 885, corresponds closely in position and thickness with that next below the Harlan bed on Long branch.

The Harlan and Leonard beds should come into the section at about 985 and 1125, but they appear to be cut out by sandstone. The Harlan bed is opened on the next stream east.

The Keokee bed as given in figure 167, on Jonathan L. Cornett land, at 1165, on the right 150 feet above the branch, was sampled with the lower parting included, and also as given in figure 168, the 39-inch seam only, the coal above it being too much weathered for the purpose. Both samples were taken by Mr. Thruston and analyzed by Dr. R. Peter, under numbers 2890 and 2684, respectively, as follows:

KEOKEE COAL.	No. 2890	No. 2684
Moisture.....	2.30	1.84
Volatile combustible matter.....	31.50	31.12
Fixed carbon.....	61.60	62.28
Ash.....	4.60	4.76
	100.00	100.00
Sulphur.....	.560	.794
Color of ash.....	Light brownish gray.	Light buff
Coke.....	Spongy.	Dense spongy.

No. 2684. "A somewhat weathered sample of what appears to be a splint coal, much of the sample in a powdered condition. Some fibrous coal and softer, brighter lumps in the sample."

The bed next above the Keokee, though not recognized below on Poor fork becomes quite conspicuous farther up stream.

The upper coal of the section, on William Cornett land, is at the right height for the Low Splint bed, but the cannel shale at the top is rather indicative of the bed below that one, as found at several points on Clover fork, notably on Fugitt creek.

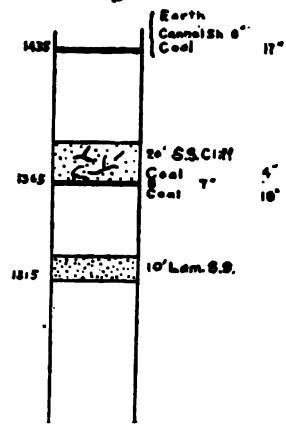
LICK BRANCH.

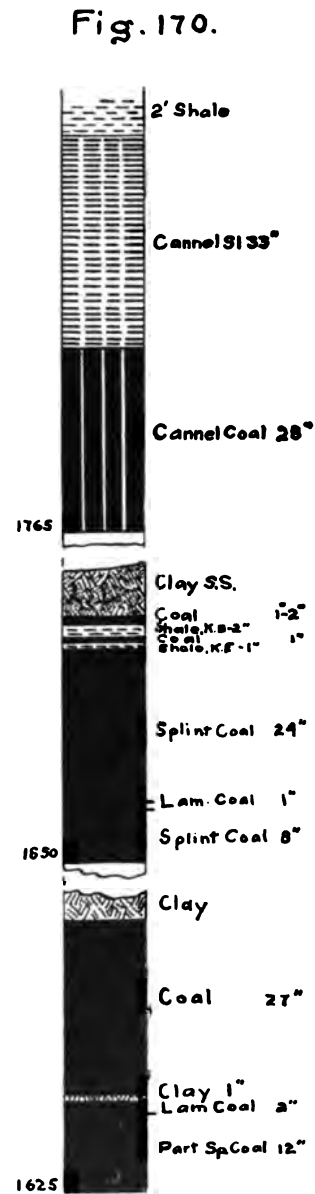
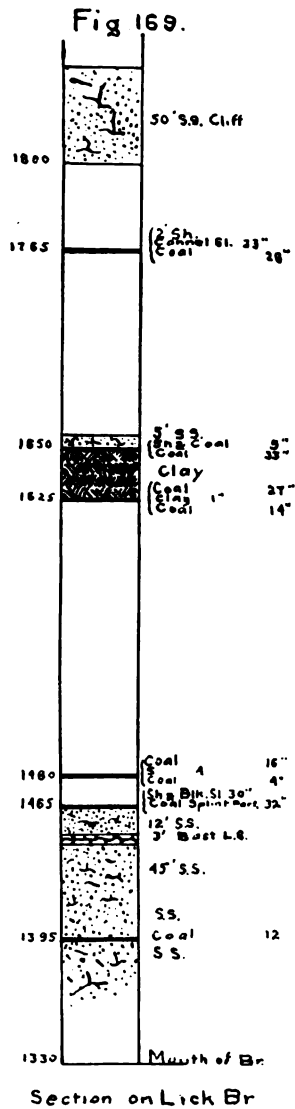
On the right, 13½ miles up Poor fork; elevation of mouth, 1330.

Figure 169 shows the coals found on this branch (on the way to Garner branch) and figure 170 the principal coals on larger scale. No correction is made for dip in either figure.

The 32-inch coal, at elevation 1465, is evidently of the same bed as that at elevation 1545 on Turkey-Pen branch. The coals at elevations 1625 and 1650 are two parts of the Harlan bed, and the coal at 1765 is of the Keokee bed. Though the latter opening is but 45 feet below that of the Low Splint (?) bed on Turkey-Pen branch, there can be little question that the two are not of the same bed, even with their similar capping, the dip of the Low Splint (?) coal, opened far up the branch, having

Fig. 167.





Keokee & Harlan Coals, L. Cornett.

brought it nearly to the level of the Keokee where it is opened, $\frac{1}{2}$ mile up the branch, nearly over the Harlan coal opening. The dip here is but 2 degrees. (G.)

The Keokee cannel appeared of good quality, light weight and good fracture. A remarkable instance of the readiness with which one kind of coal may replace another was found here. On breaking a piece of the cannel, about a 6 to 8 inch cube, uniform as far as could be seen and not suspected of being other than pure cannel, a lump of pure splint coal, measuring about 1 by 2 by 3 inches was found in the middle.

GARNER BRANCH.

On the right, $13\frac{3}{4}$ miles up Poor fork; elevation of mouth, 1330.

The section taken on this branch, figure 171, is virtually Mr. Thruston's, except that my more recent measurements of the two upper coals are substituted for his, which are given in figure 172. Though this branch seems to offer an excellent opportunity for a full development of the series of coal beds those that were found were not sufficiently characteristic to make their correlation certain, but there can be little question that the interpretation following is substantially correct.

To the difference in height of any two openings something must be added, on account of the dip, to obtain the true intervals between beds.

The lowest coal of the section, reported 24 inches thick, will answer for the 32-inch coal, at elevation 1465, on Lick branch. The Harlan coal, as on Turkey-Pen branch, was not found.

The coal at 1770, though high for the Keokee, seems most likely to be of that bed, but is possibly the same as that one found 10 feet above the Keokee on Turkey-Pen branch. Clay was reached at the bottom of the opening, but it may have been of a parting. The cannel coal is not of good quality.

The Low Splint (or bed close below it) is at elevation 1895.

Analysis No. 2674 of the 36 inches impure cannel

Fig. 171.

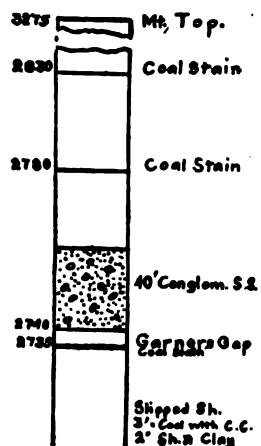
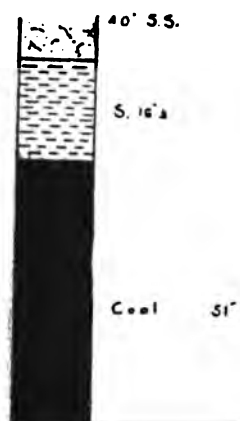


Fig. 172.



coal given below shows it to be little more than cannel slate.

The coal at elevation 2085 is at about the level of the Dean coal, but the parting in that bed was evidently not conclusive evidence.

The fossil limestone at elevation 2470 is the lowest bed on this branch fixed beyond question, to which all under it must be made to conform.

The 36-inch coal at elevation 2615 seems to be a rather regular attendant of the Cornett bed above it, but elsewhere the other small coals below it are generally wanting. An analysis of the coal is given below, under No. 2675. Ganner spring issues from this bed or close above it.

Question arose on examining the recent opening at elevation 2635, figure 171, if the coal there had slipped from the bed 10 feet higher, and Mr. Thruston's finding only 25 inches of coal at that level, figure 172, seems to answer it affirmatively.

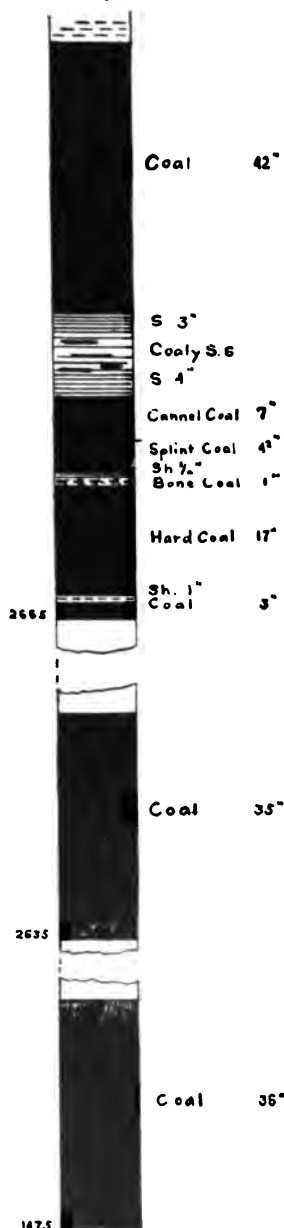
The top coal of the two figures harmonize, that part of the bed below the 2-foot parting in figure 171 not having been discovered in the original opening, figure 172.

This bed, first discovered here or on Island branch, on land of John L. Cornett, was given the name of Cornett by Mr. Thruston.

Two samples were taken of the coal here (not on Island branch), No. 2677 of the 23-inch seam and No. 2676 of the 51-inch seam, analyses of which follow. These samples were all taken by Mr. Thruston and analyzed by Dr. R. Peter.

GARNER BRANCH.	No. 2674.	No. 2675.	No. 2677.	No. 2676.
Moisture.....	1.00	4.62	1.90	6.08
Volatile combustible matter.....	29.50	32.98	36.00	32.72
Fixed carbon.....	31.60	58.30	56.10	58.20
Ash.....	37.90	4.10	6.00	3.00
	100.00	100.00	100.00	100.00
Sulphur.....	.613	.475	.461	.311
Color of ash.....	Brown	Very light brown.	Light brown.	Light brown.
Coke.....	Pulverulent	Pulverulent.	Spongy.	Pulverulent.

Fig. 173.



John L. Cornett, Island Bn

No. 2675. "A much weathered and dirty sample. (Dust was sifted out before analyzing.)"

No. 2677. "The sample contained some slaty pieces, which were retained when it was analyzed."

No. 2676. "A much weathered sample. The dust was sifted out before analyzing."

The conglomerate sandstone of the section, figure 171, was found in a cliff $\frac{1}{4}$ mile west of Garner gap, with coal under it. This coal is, doubtless, of the High Splint bed, and probably underlies the gap about 25 feet. Though with little cover here there is ample area for mining on either side of the gap. The top as given in the section is the Knob between the heads of Miller and Joe's branches, Clover fork.

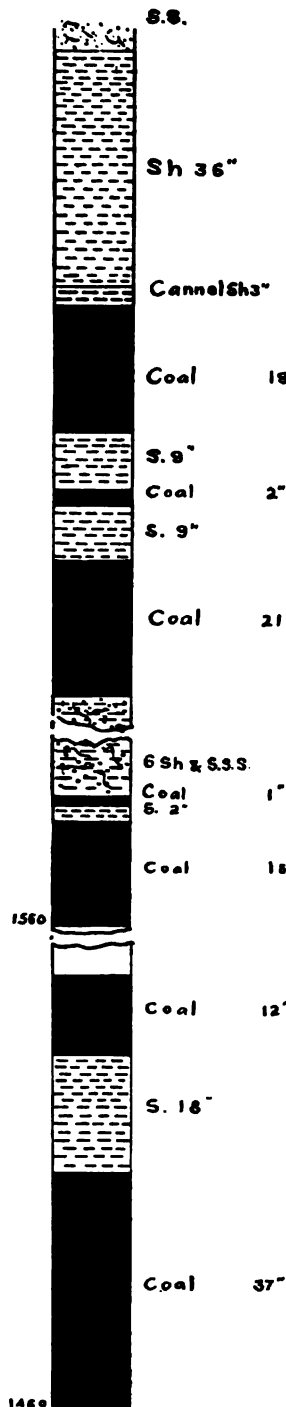
ISLAND BRANCH.

On the right, $14\frac{1}{4}$ miles up Poor fork; elevation of mouth, 1335.

Figure 173 represents the principal coals found on this branch, by Mr. Thruston.

The lower coal, near the mouth of the branch, with a dip of 20 degrees, is unidentified but probably well down below the Harlan bed. His sample of the coal from this bed, of some of its coal sent to Quinnimont, W. Va., to test for coking, and of the resulting coke after 72 hours burn-

Fig. 174.



Long Br. Coals.

ing, analyzed by Dr. R. Peter, gave the following results:

36" COAL.	No. 2678.	No. 2708.	No. 2712.
Moisture.....	2.02	1.28	1.34
Vol. comb. matter	32.98	29.20	
Fixed carbon.....	52.70	56.68	80.76
Ash.....	12.30	12.86	17.90
	100.00	100.00	100.00
Sulphur.....	.546	.848	.648
Color of ash.....	Light salmon.	Gray.	Light gray.
Coke.....	Spongy.	Dense spongy.	

No. 2678. "A slightly weathered sample, containing some slaty pieces. Part of it is bright fat coal."

No. 2708. "A somewhat dull-looking sample of splint coal, breaking into thin irregular laminae."

Some fibrous coal between, but no apparent pyrites."

A 16-inch coal under sandstone, with 3 inches of cannel shale intervening, elevation 1765, probably corresponds with the coal at elevation 1770 on Garner branch. The Dean coal was noted between sandstones at elevation 2105, its thickness not given.

The only other coals found on this branch are the Cornett and one below it, the upper coals of figure 173.

LONG BRANCH.

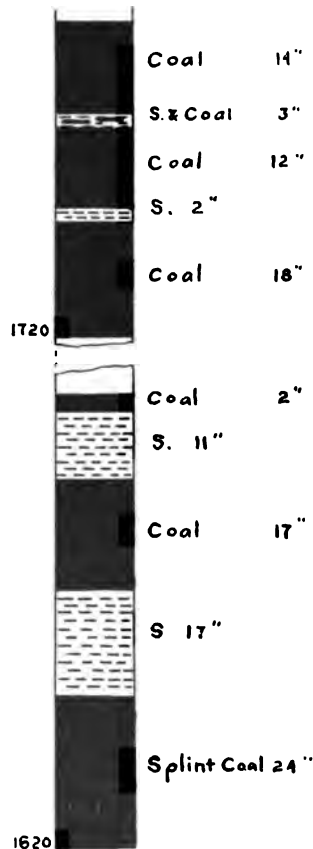
On the right, 14½ miles up Poor fork; elevation of mouth, 1335.

Besides a coal 10 feet above the mouth of this branch, not opened, but with a dip of 25 degrees, only those of figure 174 are noted by Mr.

Thruston. The lower one of these may be the same as the 36-inch bed on Island branch, but with $17\frac{1}{2}$ degrees dip there correlation is uncertain.

The Harlan bed probably appears at elevation 1560, in two parts, less separated than on Lick branch and with slight dip. The bed is rather low for the Harlan, however, and it is possible that this is another appearance of the bed under the Harlan, found on Jack branch, $15\frac{1}{2}$ miles up Poor fork, at elevation 1475.

Fig 175



John L. Cornett, Katy Br.

COAL BRANCH.

On the right, $14\frac{1}{2}$ miles up Poor fork; elevation of mouth, 1340.

Following is an analysis by Dr. R. Peter, of the fossil limestone found on this branch, at elevation 2545, by Mr. Thruston:

FOSSIL LIMESTONE. (Air-dried.)	
	No. 2478.1
Lime carbonate.....	59.00
Magnesia carbonate.....	1.82
Alumina, iron oxide, etc.....	4.80
Soluble silica.....	1.38
Insoluble silica and silicates.....	16.36
Bituminous matter, moisture, etc.....	16.64
	100.00

"A dull, fine-grained, gray-black limestone, containing whitish fragments of fossil shells. It is probable that this limestone may give hydraulic cement," but the quantity is altogether insufficient as the bed is rarely so much as 3 feet thick.

KATY BRANCH.

On the right, $14\frac{7}{8}$ miles up Poor fork; elevation of mouth, 1340.

Mr. Thruston's notes of this branch show the coals of figure 175 with three smaller coals below them. The dip is strong near the mouth of the branch and slight at the upper coal. As compared with other points in neighboring branches, these two beds correspond fairly well with the Harlan and Leonard beds, with, perhaps, the lower portion of the Harlan unopened.

His estimated thickness of strata from Poor fork to the lower bed, is, however, only 420 feet, which would indicate it far below the Harlan, except that here there is probably room north of Poor fork before coming to the top of the prominent conglomerate on the face of Pine mountain for the first 500 to 600 feet of strata found on Straight and Turkey-Pen branches. In other words, the bed of Poor fork is here near to the synclinal axis; and has cut much less deeply into the strata in consequence.

The fossil limestone was found at elevation 2470.

HIGHBANK BRANCH.

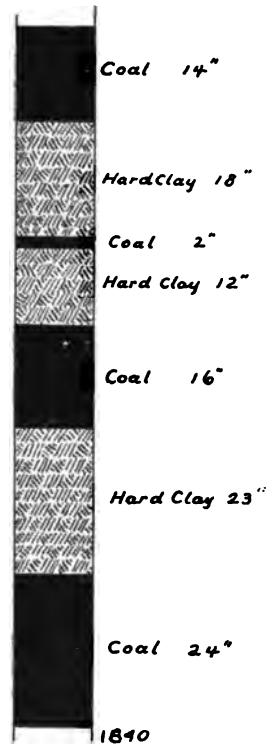
On the right, 15 miles up Poor fork; elevation of mouth, 1340.

On this branch Mr. Gardner found the coal of figure 176 again at about the usual height of the Harlan coal, on George Isom's land, $\frac{3}{4}$ mile up the branch. Coal signs found 25 feet under this are, perhaps, a second portion of the bed.

Mr. Thruston found the Jonathan Lewis cannel coal as in figure 177, the change from cannel coal to cannel shale so gradual as to render 9 inches doubtful as to which to call it. This bed is so like that under the Low Splint opposite on Fugitt creek near its mouth, as to make correlation probable. Assuming the coal at elevation 1640 to be the Harlan, and allowing 100 feet for dip brings the cannel to the right height for that bed, about 380 feet above the Harlan.

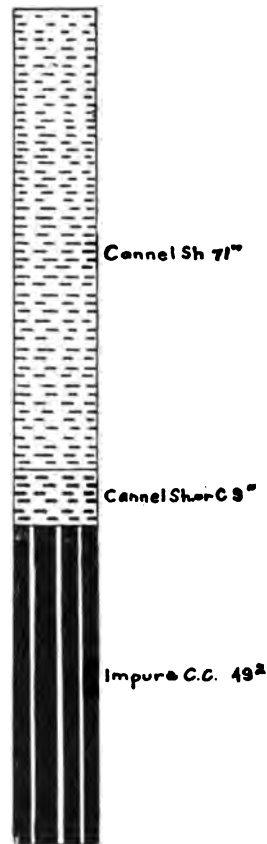
The Dean coal was found, but thickness not obtained, at elevation 2180. A rough estimate of thickness of strata from Poor fork to the Dean coal placed it at 1320 feet.

Fig. 176.



Geo. Isom, Higbank Br

Fig. 177.

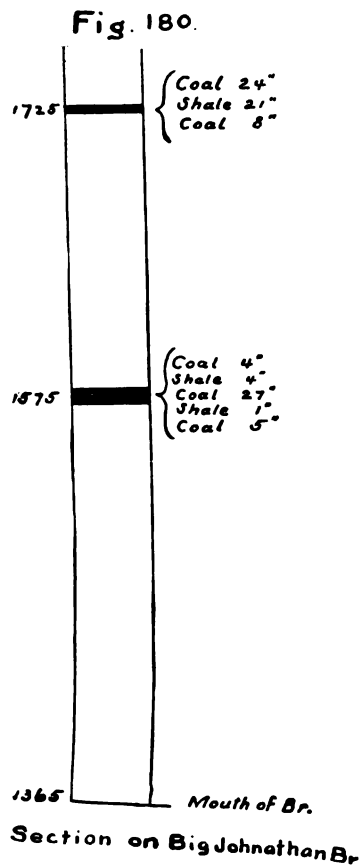
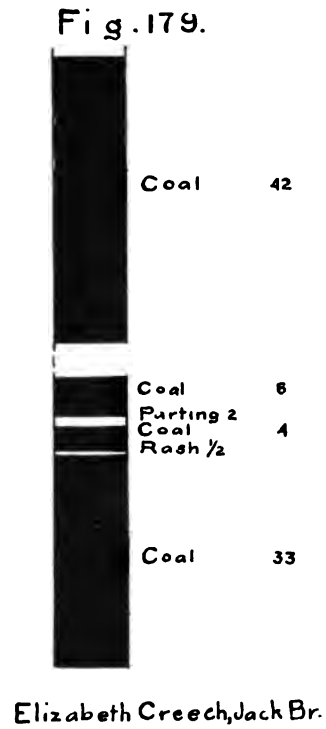
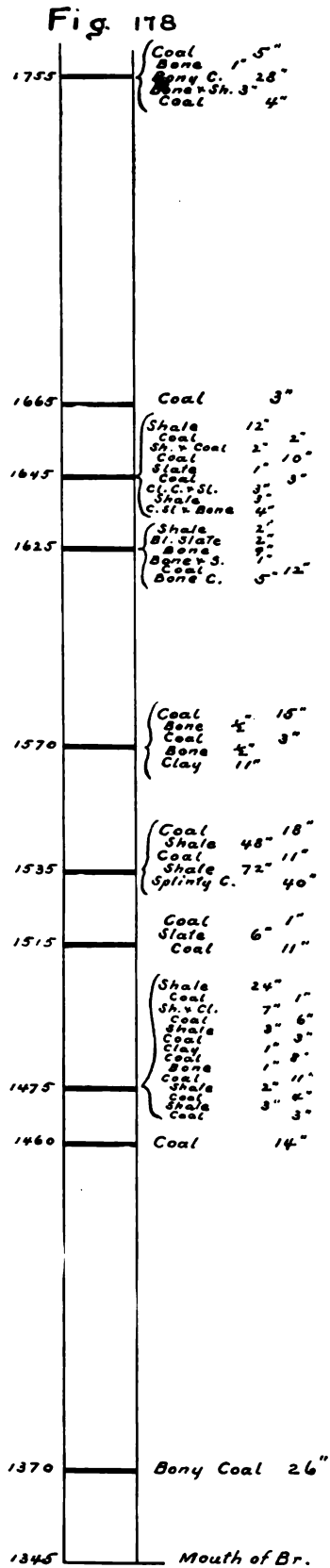


Higbank Br.

JACK BRANCH.

On the right, 15½ miles up Poor fork; elevation of mouth, 1345.

The numerous coals found on this branch by Mr. Gardner are represented in figure 178. As is apt to be the case with those not familiar with the coals of this region, much supposed to be good splint coal here, and at other points, has been mistaken for bone.



The coal at elevation 1535, on Deep branch, $\frac{1}{2}$ mile up, was thought by him to be of the Harlan bed, and its thickness is indicative of it, but it is about 100 feet lower than was to be expected, and, having a dip of 13 degrees, it must rapidly fall lower still. It would seem that an error of 100 feet had been made in its height for then the upper bed, $\frac{3}{4}$ mile up, with dip of 2 degrees, would answer for the Keokee, as reported by another observer. The numerous other coals of the section do not aid in correlation.

In addition to the above the coals of figure 179 were reported, but without heights or definite location.

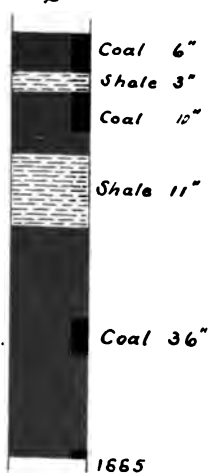
The lower one was stated to be of the lower part of the Harlan bed, and near to George Isom's (Highbank branch?) The higher one, doubtless the same as the top bed of the section, of the Keokee bed.

BIG JONATHAN BRANCH (G.)

On the right, $16\frac{3}{4}$ miles up Poor fork; elevation of mouth, 1365.

No data were obtained for correlating the two coals found on this branch, given in figure 180. Their elevation and comparison with the Jack branch coals should be of assistance in farther prospecting.

Fig. 181.



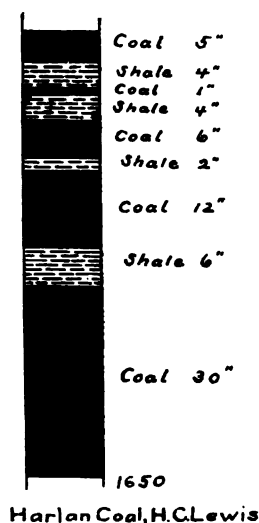
Harlan Coal, J.L. Cornett, Sr

EASTEP BRANCH. (G.)

On the right, $17\frac{1}{4}$ miles up Poor fork; elevation of mouth, 1380.

The Harlan coal now becomes well defined again, as shown in figure 181, at slightly higher elevation than heretofore on Poor fork. It was opened $\frac{3}{4}$ mile up the branch.

Fig 182.

APPLE ORCHARD BRANCH (G).

On the right, 18 miles up Poor fork; elevation of mouth, 1400.

Figure 182 shows the Harlan coal as opened on this branch, $\frac{1}{2}$ mile up, with dip of 5 degrees.

NEPHEW BRANCH.

On the right, $18\frac{1}{2}$ miles up Poor fork; elevation of mouth, 1420.

Figure 183 gives Mr. Gardner's measures of the Harlan coal, $\frac{1}{2}$ mile up the branch, with 4 degrees dip, and of the Leonard coal. Figure 184 gives earlier, reported measures of the same beds; probably from different parts of the same openings.

The Keokee bed also was reported,

Coal.....	21"
Parting.....	7"
Coal.....	5"

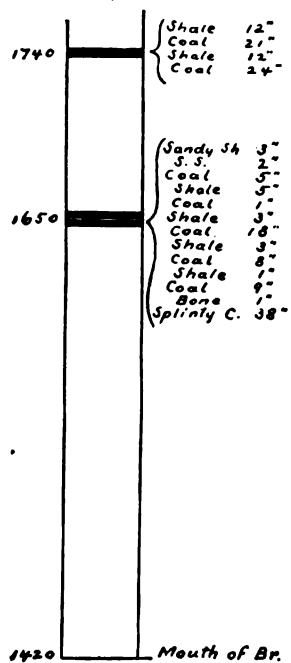
but without elevation given.

PERKINS BRANCH.

On the right, 19 miles up Poor fork; elevation of mouth, 1440. This appears to be the Tantrough branch of Mr. Thruston's time of visiting.

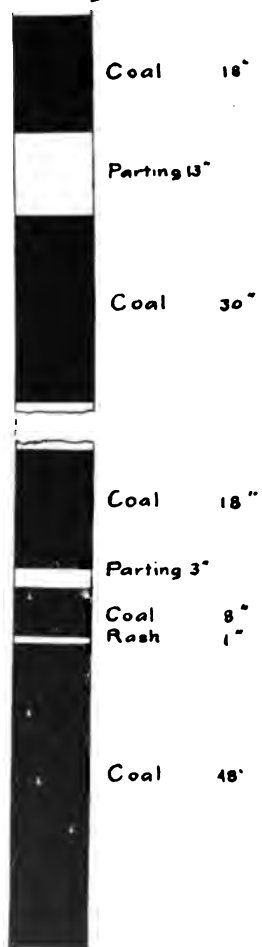
Mr. Thruston's measurements of Ebenezer Dickson's Harlan coal, on the left, $\frac{3}{8}$ mile up that branch, are given in figure 185, and following is an analysis, by Dr. R. Peter, of his sample of the coal.

Fig. 183.



Section on Nephew Br.

Fig. 184.



Nephew Br.

HARLAN COAL.

No. 2670.

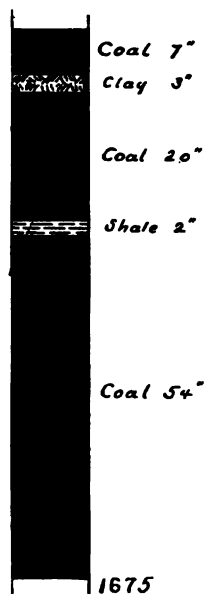
Moisture.....	1.60
Volatile combustible matter.....	35.00
Fixed carbon.....	57.40
Ash (reddish brown).....	6.00
	100.00
Sulphur.....	.558
Coke.....	Spongy.

"A much weathered sample"

In figure 186 are given the coals found by Mr. Gardner, the lower, Harlan coal, $\frac{1}{2}$ mile up, being probably at about the same place as that next preceding. The dip here is 4 degrees. The higher coal is probably of the Keokee bed.

Figure 187 gives what are reported as the Harlan and Leonard beds on the T. C. Lewis land, and above them, all without elevations, was reported the Keokee bed, with section identical with Mr. Gardner's upper coal.

Fig. 188.



Harlan Coal.

On the right, $19\frac{1}{2}$ miles up Poor fork, 220 feet above and $\frac{1}{4}$ mile from it, the Harlan coal is opened as in figure 188 (G.) It is quite probable that on carrying the opening to roof higher coal in the bed would be found, as in other Harlan coal openings of this vicinity.

MEADOW BRANCH.

On the right, 20 miles up Poor fork, elevation of mouth, 1480. This is evidently Mill branch of the time of Mr. Thruston's visiting in 1885.

Figure 189 represents the section of this branch as taken by Mr. Gardner up to the Harlan coal, and from it to the top by Mr. Thruston.

The Harlan coal was measured by Mr. Gardner, on Nolan land, $\frac{1}{2}$ mile up the branch, with 3 degrees dip, is given in figure 190.

Fig. 185.

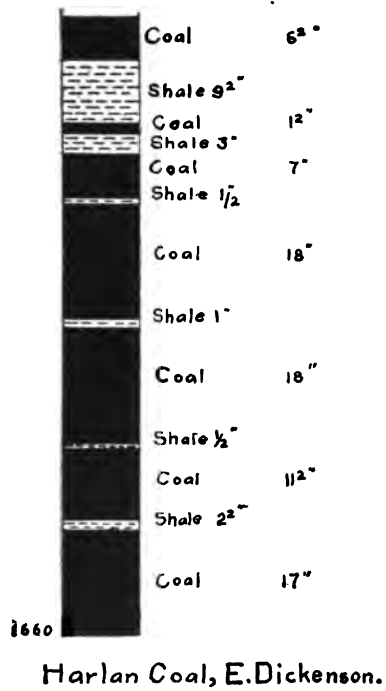


Fig. 186.

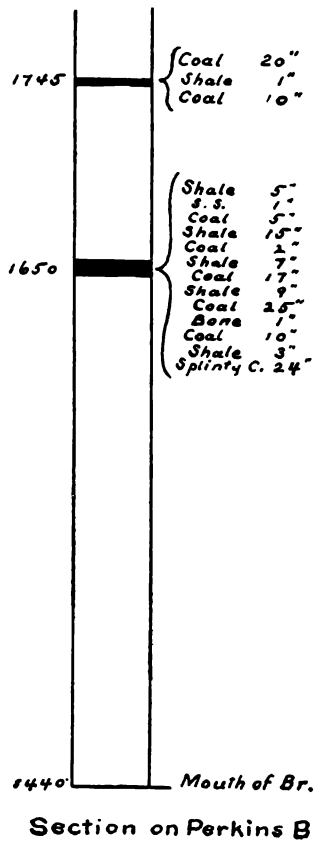
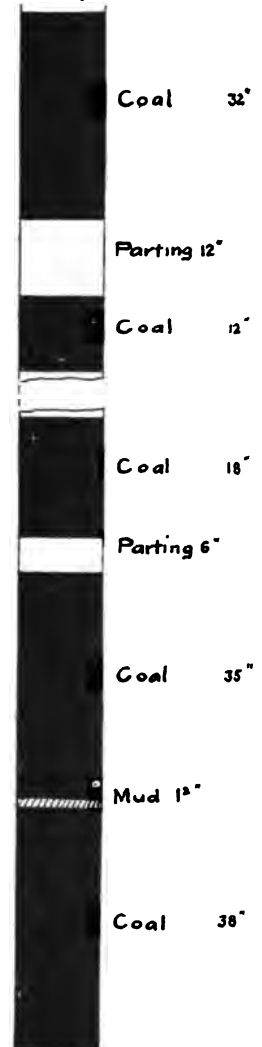
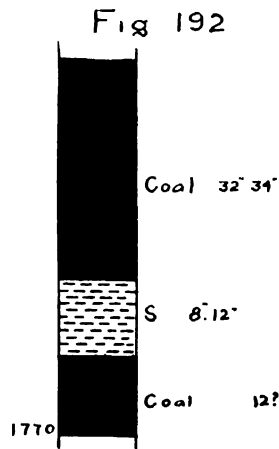


Fig 187



Leonard and Harlan Coals, J.C. Lane.

The Keokee bed is probably represented in the coal at elevation 1770. A second opening in the same bed gave the coal of figure 191, and a third with the same top coal as the last, and but 3 inches parting, was reported to have 24 inches of bottom coal. Some doubt as to the elevations of these openings arises from the fact that they were on different branches, and, therefore, likely to be at somewhat different levels, not noted.



A. B. Lewis, Jr., First Rt. Br.

The coal of figure 192, found at the mouth of the second right branch is, doubtless, of the Low Splint bed.

Grassy gap to Fugitt creek, at the head of the first (?) right branch, is at elevation 3190, well above the High Splint coal.

CLOVER LICK CREEK.

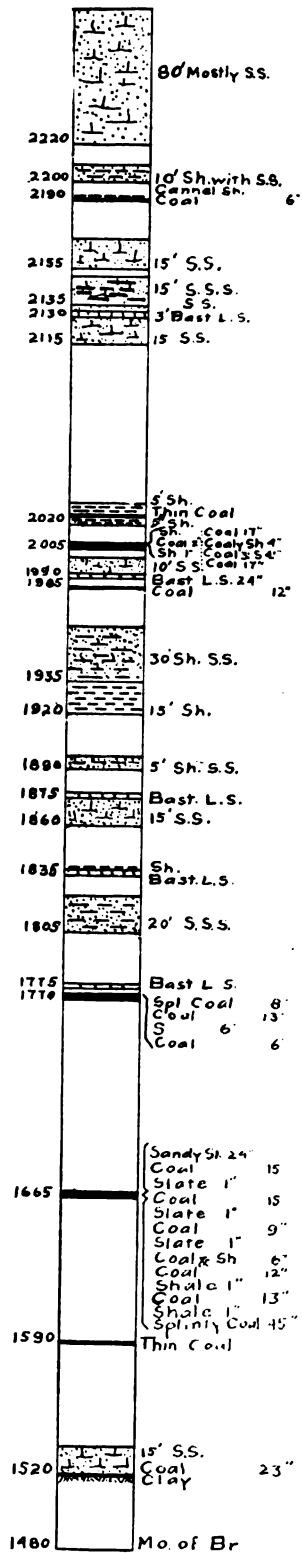
On the right, 22 miles up Poor fork; elevation of mouth, 1525.

For a general view of the coals of this vicinity see the longitudinal section, figure 4.

Pebbles in profusion, scattered about the flat field of the Isaiah Creech house, $\frac{1}{4}$ mile up Clover Lick and $\frac{1}{4}$ mile to the left, are of interest as possibly locating the conglomerate there. It is also possible that they were washed there from Pine mountain, when the Poor fork bed was some 60 feet higher than now. They occur at elevations 1585 to 1595, where strata pitch slightly south-east, with the place of the Harlan coal probably 75 to 100 feet higher. On Roberts branch (34 miles up Poor fork) they lie in like manner, apparently directly under the place of the Harlan coal.

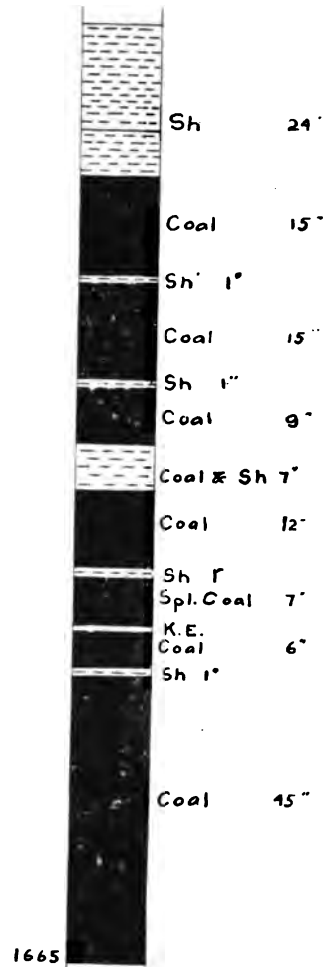
On the right of Clover Lick creek, 1 mile up, the Harlan coal is reported to have the section of the lower bed of figure 193, with a total of coal $107\frac{1}{2}$ inches and of partings of 19 inches. Analyses of this coal and of its coke are reported as follows:

Fig. 189



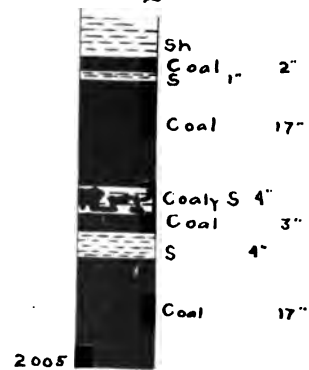
Section on Meadow Br.

Fig 190.



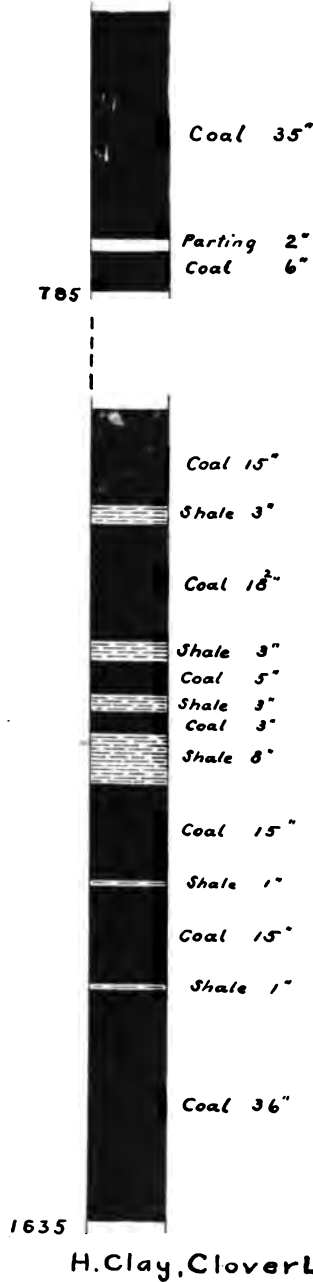
Harlan Coal, C.F.C. Nolan.

Fig 191



A.B. Lewis, Jr., Second Rt. Br.

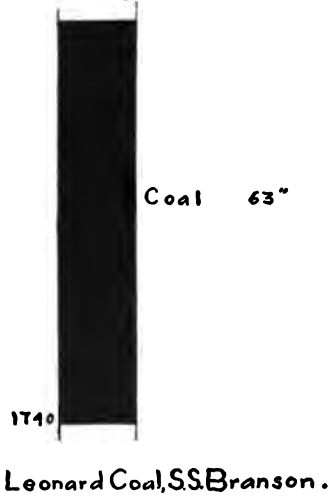
Fig. 193.



HARLAN COAL.	Coal.	Coke.
Volatile matter.....	38.40	2.10
Fixed carbon.....	57.60	89.50
Ash.....	4.00	8.40
	100.00	100.00
Sulphur.....	1.21	1.11
Phosphorus.....	.011	.015

The upper coal of figure 193, with bed-section similar to that of the Keokee on Meadow branch, is undoubtedly the same coal. The opening being farther south than that of the Harlan coal of the same figure, brings the two beds apparently somewhat closer together than they really are.

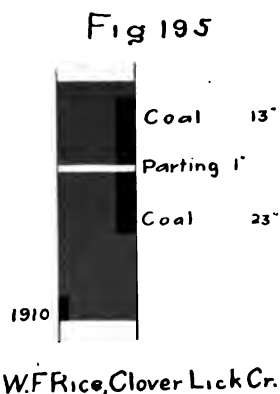
Fig. 194.



The old Branson entry of figure 194, on the left, $1\frac{1}{8}$ miles up Clover Lick creek, 170 feet above it, long regarded as of the Keokee bed is, more likely, of the Leonard, Mr. Thruston having found sign of the Harlan bed 115 below it, and the Keokee with but 24 inches coal, 40 feet above it. His early measure of coal was 60 inches, which he sampled and coked at Quinnimont. Analyses of the coal for coking and of its 72-hour coke, as determined by Dr. R. Peter, and of later private analyses of the coal and its coke from the entry 20 yards in, are given below, the numbered analysis having been made for the Survey:

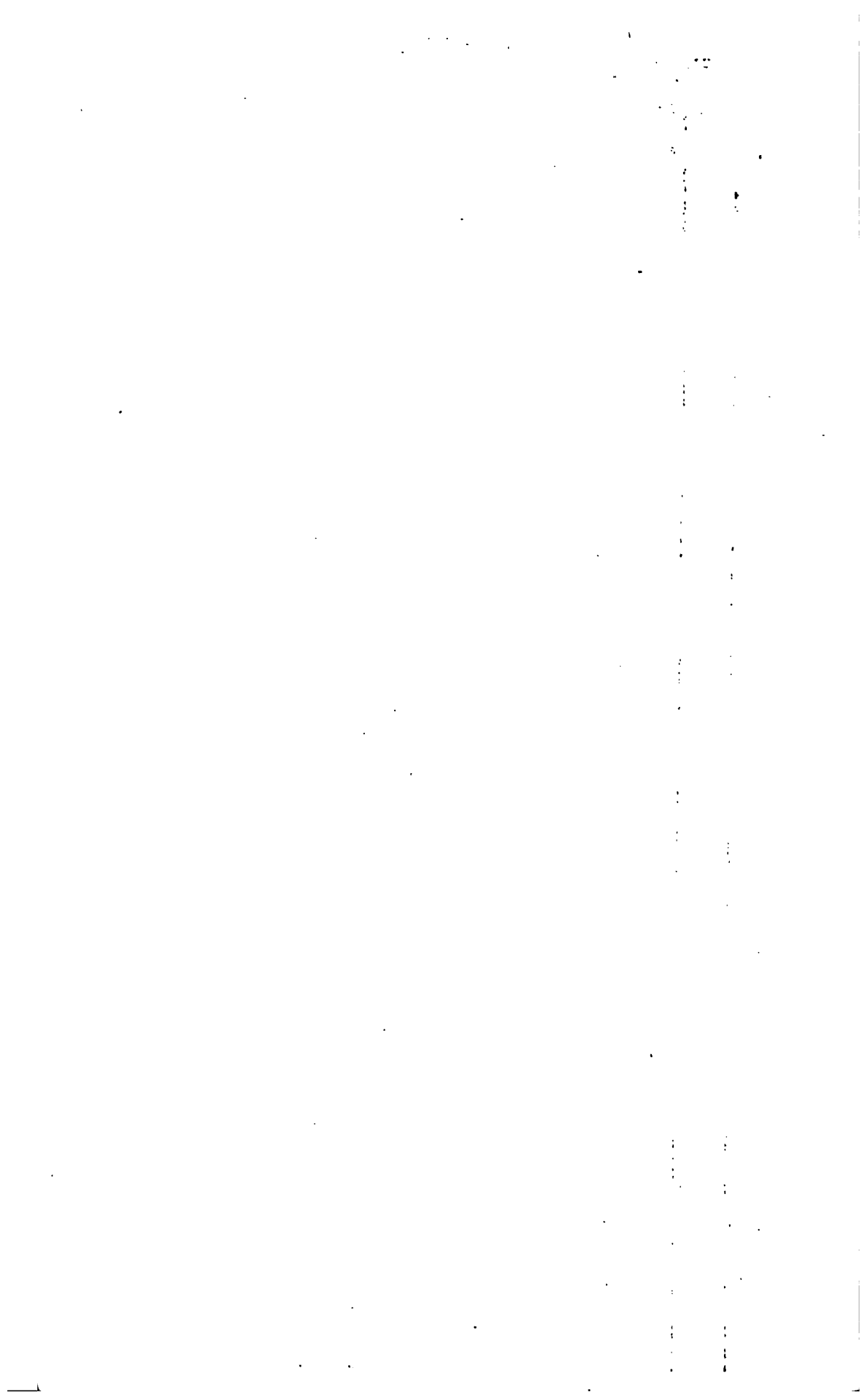
LEONARD BED.	No. 2710. Coal	No. 2713. Coke.	Coal.	Coke.
Moisture.....	1.30	0.40		
Volatile combustible matter.....	37.10		41.00	3.55
Fixed carbon.....	58.24	93.60	55.10	88.20
Ash.....	3.36	6.00	3.90	8.25
	100.00	100.00	100.00	100.00
Sulphur.....	1.290	1.068	.825	.770
Phosphorus.....			.007	.021
Color of ash.....	Light brown gray	Light gray brown.		
Coke.....	Dense spongy.	Very good.		

Of the latter coke it is remarked: "Good color, weight and structure. Not quite so heavy as Dorchester (Virginia) coke."



Coal is reported 130 feet above the Keokee as of the bed next above. Its reported bed-section is given in figure 195. The bed appears to be too low for one of the Low Splint group, and 100 feet too high for that to which it was referred. Across the creek, on Pounding Mill branch, the bed next above the Keokee is but 15 feet from it. It is not to be supposed that the interval has increased to 130 feet here.

This coal and its coke were analyzed with the following results:



	Coal.	Coke.
Volatile matter.....	38.50	2.40
Fixed carbon.....	54.15	88.10
Ash.....	7.35	9.50
	<u>100.00</u>	<u>100.00</u>
Sulphur.....	1.183	.757
Phosphorus.....	.008	.008

"Coke of good color, very good weight, good close structure."

Pounding Mill Branch.—On the right, $1\frac{1}{4}$ miles up Clover Lick creek; elevation of mouth, 1580.

Figure 196 shows the section found on this branch, the lower coals enlarged in figure 197 and the high ones in figure 199. The bottom coal of the section is taken from Mr. Thruston's notes as are also data given in the section between the two groups of coals.

The bottom coal opened by the creek at its mouth, is of the Harlan bed without question. Its measurement by Mr. Gardner is given in figure 197. Differences in his measure and Mr. Thruston's are to be accounted for largely by the change in the section disclosed by working farther into the bed, though the opening is still not under roof.

The beds at 1720, 1770 and 1775, on the right, $\frac{1}{8}$ mile up, are referred to the Leonard, Keokee and bed next above the latter. The three beds as found on Slick Rock branch, Big Looney creek, show a similar section with rider over the Leonard bed, as here, but smaller, and with no such partings in the Keokee as appear here.

Figure 198 represents coals reported found on land of S. W. Smith and referred to the Leonard, Keokee and McKnight beds. The elevation were not given.

The absence of coals in the middle part of the section of figure 196 is due to lack of prospecting for them. None has been attempted that has come to my knowledge.

The three coals of figure 199 were opened on the left just below the junction of the forks coming from Sourwood and Indian Grave gaps.

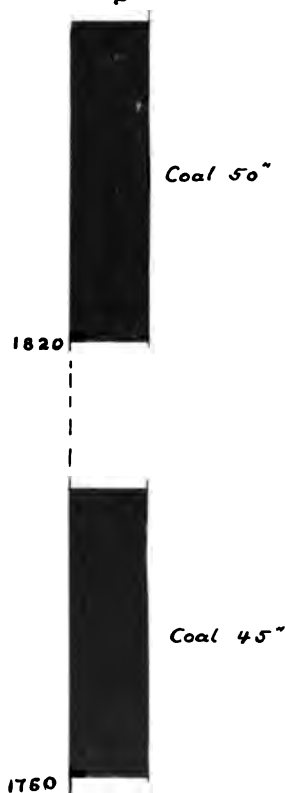
The Cornett bed at the bottom of these was opened in a second place, 100 yards northeast of the first, with but two inches of coal in the middle, and only 3 inches of shale in the two partings combined. East of this opening the bed is known to be of workable thickness.

The bed next above the Cornett also thins eastward, but remains quite constant as a hard, sometimes slaty splint coal.

The High Splint coal was not opened here enough to show its quality nor, perhaps, its full thickness.

The thickness of the top coal of the section is given as reported. This is the highest coal bed yet found, and

Fig 200.



A. Blair, Clover Lick.

the only opening made into it. The coal is a fine-looking bright and light weight splint, as seen on the dump, and is reported uniformly so through its bed-section.

Coals opened on the A. Blair land, on the left, $1\frac{1}{2}$ miles up Clover Lick creek are given in figure 200.

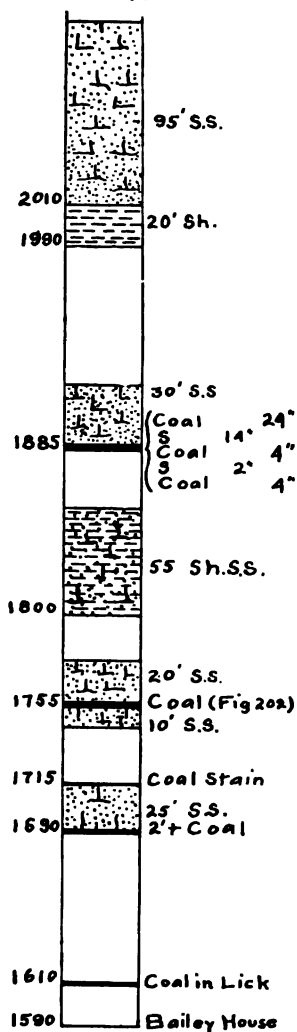
The lower coal, 175 feet above the creek, is of the Leonard bed which, by reported analysis of its coal and coke, gave:

LEONARD BED.	Coal.	Coke.
Volatile matter.....	39.70	2.00
Fixed carbon.....	57.40	94.40
Ash.....	2.90	3.60
	100.00	100.00
Sulphur.....	.550	.688
Phosphorus.....	.010	.008

"Good color, weight and structure."

The higher coal of the figure was reported of the Keokee bed, the interval from the Leonard is rather large for it.

Fig 201.



Section at Bennett Baileys.

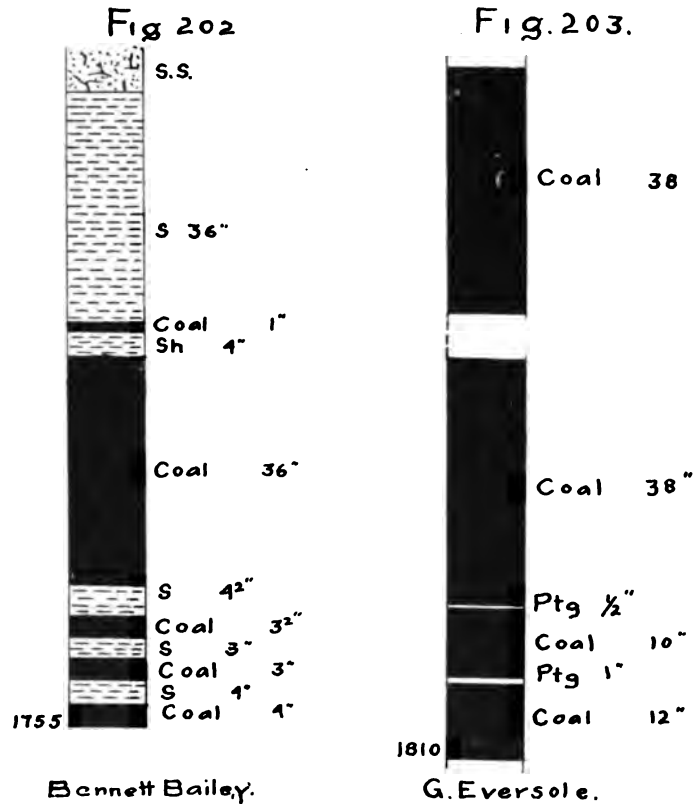
Again on the left, $1\frac{1}{2}$ miles up Clover Lick creek, Mr. Thruston found the section of figure 201 on the Bennett Baily land (possibly, later A. Blair.)

The lower coal, found in a lick back of the house, is probably of the Harlan bed. The two coals at elevations 1715 and 1755, found in a small hollow below the house, are of the Leonard and Keokee beds. The latter is shown enlarged in figure 202. The upper coal of the section corresponds with the Rice coal, figure 195.

Comparing the elevations of the Branson and Rice coals with those just given a close agreement is found. The Blair coals as given are about 40 feet too high for conformity, due doubtless to barometric inaccuracies.

On the left, $2\frac{1}{4}$ miles up Clover Lick creek, on G. Eversole land, coals reported of the Leonard and Keokee beds, but seeming, rather, to be of the Keokee and bed above it, were opened as shown in figure 203. Elevation of beds was given as 1810. It probably applies to the upper bed only. Analysis of the lower coal was reported:

Volatile matter.....	38.60
Fixed carbon.....	57.80
Ash.....	3.60
	100.00
Sulphur.....	.605
Phosphorus	.009

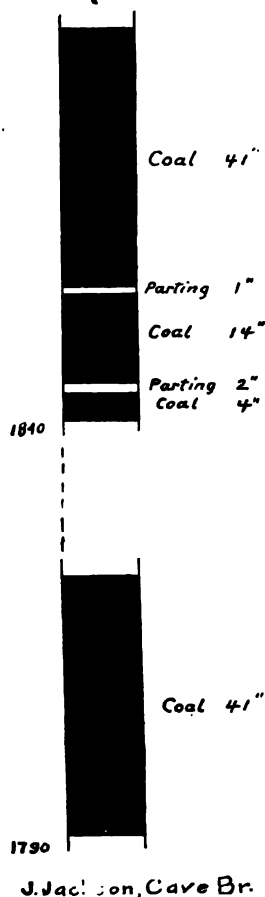


Cave Branch. On the right, $2\frac{1}{4}$ miles up Clover Lick creek; elevation of mouth, 1645.

The two openings on this branch given, as reported, in figure 204 appear to be of the Keokee bed and the one above it.

The lower bed is opened on the left of the branch, 145 feet above its mouth and the upper bed on the right 195 feet above the mouth of the branch, as recorded by Mr. Gardner. Mr. Thruston's assistant, Mr. Morgan, found 52 inches of coal with shale roof, two small partings in the middle and three thin seams of coal underneath, apparently about on the level of Jackson's lower bed. Its section more nearly resembles the upper one.

Fig. 204.



On G. Eversole land the High Splint bed was opened, as reported, as shown in figure 205, its coal and coke analyzing as follows:

HIGH SPLINT BED. (?)		Coal.	Coke.
Coal 41"	Volatile matter.....	39.60	4.15
	Fixed carbon.....	56.40	86.35
	Ash.....	4.00	9.50
	Sulphur.....	.564	.468
	Phosphorus.....	.010	.010

The coke is called not good, but in view of the good results from this bed obtained elsewhere, it is probable that the sample was of outcrop coal, not suitable for even a proximate coking test.

On the left, 3 miles up Clover Lick creek, on Roland Eversole land, the section of figure 206 was taken. Thorough search gave no intermediate coals.

The lowest coal, reproduced with the one above it in figure 207, has 2 inches of semi-cannel coal 16 inches from the top.

The upper coal of figure 207 was measured by Mr. Gardner some 100 yards under ground, no material variation showing from the mouth of the

entry. The upper coal of the section appears to be the same as that found on the Rice place, figure 195.*

Tirey's Branch. On the left, $3\frac{1}{4}$ miles up Clover Lick creek. At the branch, $\frac{1}{4}$ mile up it, on Roland Eversole land (later A. Z. Kelly), Mr. Thruston found the coal

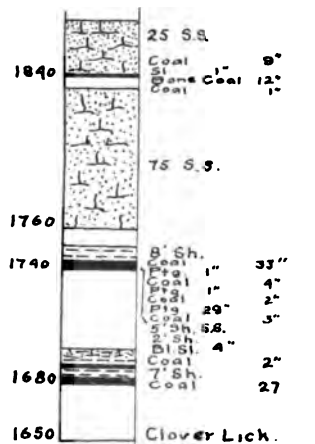
*Note.—Since this report was written it has been reported that the Dean coal, with its unmistakable fire-clay parting, has been found 400 feet above the Eversole entry. If such is the case, that entry is probably in the Low Splint bed, unexpectedly low here and rising quite rapidly northward to, or above, the upper Bailey and Rice coals already noted. The synclinal axis then crosses Clover Lick in this vicinity, and what was believed to be the Keokee coal farther up stream must be one of the Low Splint group.

Fig 205



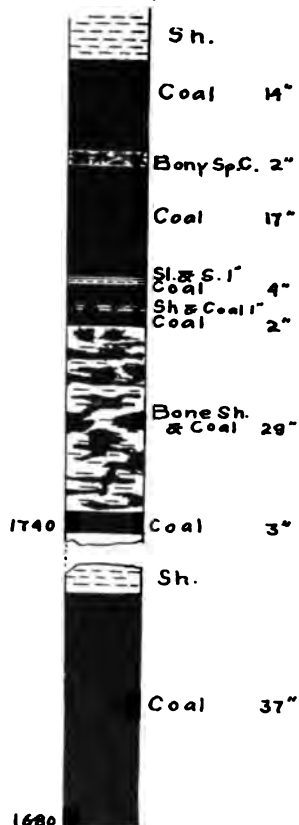
G. Eversole,
High Splint Coal.

Fig. 206.



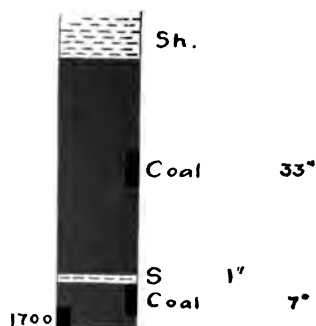
Section at Roland Eversoles

Fig. 207.



Roland Eversole.

Fig. 208.



Tirey's Br. A.Z. Kelly.

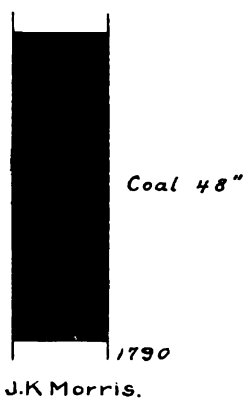
shown in figure 208, apparently of the Keokee bed. His sample of the coal, analyzed by Dr. R. Peter gave results following under No. 2671.

At the head of the branch on top of the ridge are the "Town rocks"; a group of detached masses of sandstone, of the size of small houses, elevation 3240.

At elevation 1700, in the bed of Clover Lick creek, $3\frac{1}{2}$ miles up, what he supposed to be the same bed was found by Mr. Thruston with 29 inches of hard coal under 12 inches soft, and with shale roof. His sample of this coal analyzed by Dr. R. Peter gave results following under No. 2668.

KEOKEE COAL.	No. 2671.	No. 2668
Moisture.....	1.40	1.12
Volatile combustible matter.....	32.20	33.68
Fixed carbon.....	57.20	63.10
Ash.....	9.20	2.10
	100.00	100.00
Sulphur.....	0.742	0.420
Color of ash.....	Lilac gray.	Light brownish.
Coke.....	Dense.	Spongy.

Fig. 209.

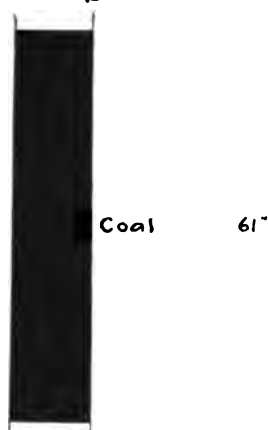


On the right, $4\frac{1}{8}$ miles up Clover Lick creek and near its level, on J. K. Morris land, the coal of figure 209 is reported, supposed to be of the Keokee bed. Its elevation as compared with the next preceding indicates an up-stream rise of strata of over 2%. This corresponds with the regular southward rise through Big Black mountain.

Following are reported analyses of coal and coke from this Morris opening:

KEOKEE (?) COAL.	Coal.	Coke.
Volatile matter.....	37.00	1.70
Fixed carbon.....	52.20	83.85
Ash.....	10.80	14.45
	100.00	100.00
Sulphur.....	.825	.605
Phosphorus.....	.025	.029

Fig. 210.



High Splint Coal, J. K. Morris.

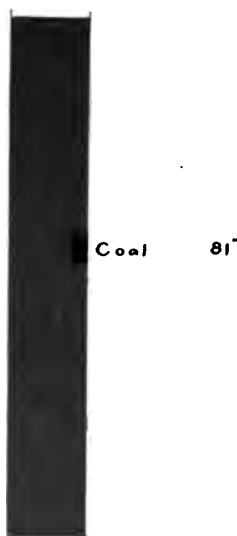
Clover Lick in any other bed near its level for which it might be mistaken.

Eastep Branch.—On the right, $4\frac{1}{4}$ miles up Clover Lick creek; elevation of mouth, 1805.

On the right of this branch, near to but 445 feet above its mouth, 26 inches of coal with two 8-inch partings is given as of the Low Splint bed. Its height of 460 feet, if correct, above the opening just described does not admit of such correlation.

Coal opened on the left of Clover Lick creek, on J. K. Morris land, is reported, doubtless correctly, of the High Splint bed with the section given in figure 210. No such thickness of coal has been found east of

Fig 211.



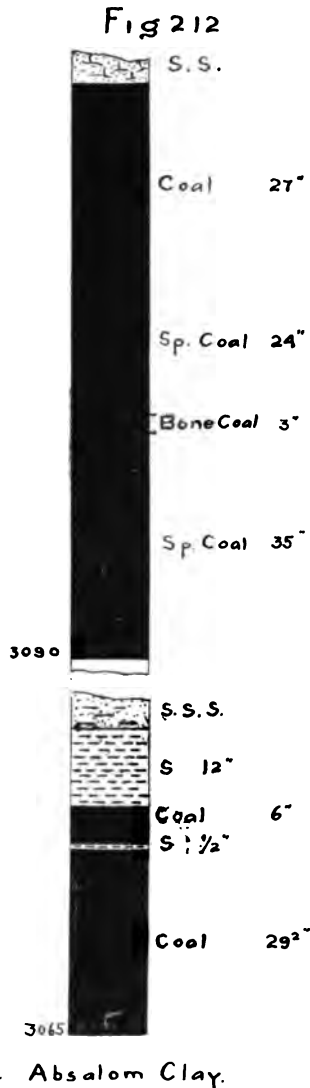
High Splint Coal, Thorps Br.

Thorps Branch. On the right 5 miles up Clover Lick creek; elevation of mouth, 1920.

The High Splint coal is reported on this branch, probably correctly, as given in figure 211.

Coal-Bank Branch. On the right of the Right fork of Clover Lick creek, $\frac{1}{2}$ mile up the fork and 6 miles from Poor fork, elevation at junction of forks, 2050.

Mr. Thruston found on this branch, 1040 feet above its mouth, the high Splint coal as given in figure 212, and sent a full section of this coal for the Survey to the Louisville and New Orleans Expositions of 1884, 1885. This sample of the coal analyzed by Dr. R. Peter, gave the following results:



HIGH SPLINT COAL. No. 2478 (a)	
Moisture.....	2.60
Volatile combustible matter.....	35.60
Fixed carbon.....	58.60
Ash (light purplish gray).....	3.20
	100.00
Sulphur.....	0.491
Coke.....	Dense spongy.
Specific gravity.....	1.264

"A bright, firm pure-looking coal. No pyrites and but little fibrous coal apparent."

"Very imperfectly laminated. Some pieces with ferruginous incrustation. It softens and swells somewhat on burning. It approaches bituminous coal in character, and would no doubt make very good coke."

Bee Branch. On the right, $\frac{3}{4}$ mile up the Right fork of Clover Lick creek. Coal on this branch was reliably reported as of the High Splint bed, 70 in. thick without parting.

On the head of the Right fork, by the second drain east of the

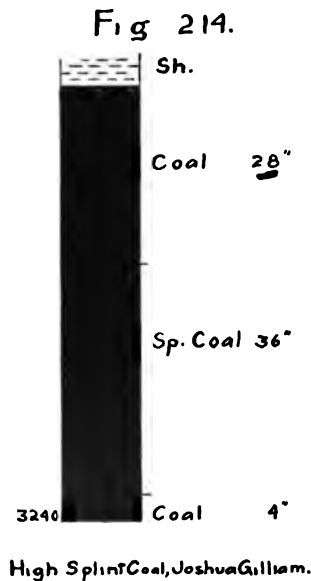
path, a half mile north of Garrison gap and 385 and 400 feet below it, the High Splint bed was opened in two places, neither of them to solid covering, but each showing 60 inches of coal, of which the lower half is splint. One of them is shown in figure 213.



A pretty thorough but unsuccessful search was made here for the Cornett bed. Only a bed about one foot thick and slaty, 30 feet below the High Splint, was found.

CLOVER LICK, LEFT FORK.

On the left $5\frac{1}{2}$ miles up Clover Lick Creek, elevation of mouth 2050.



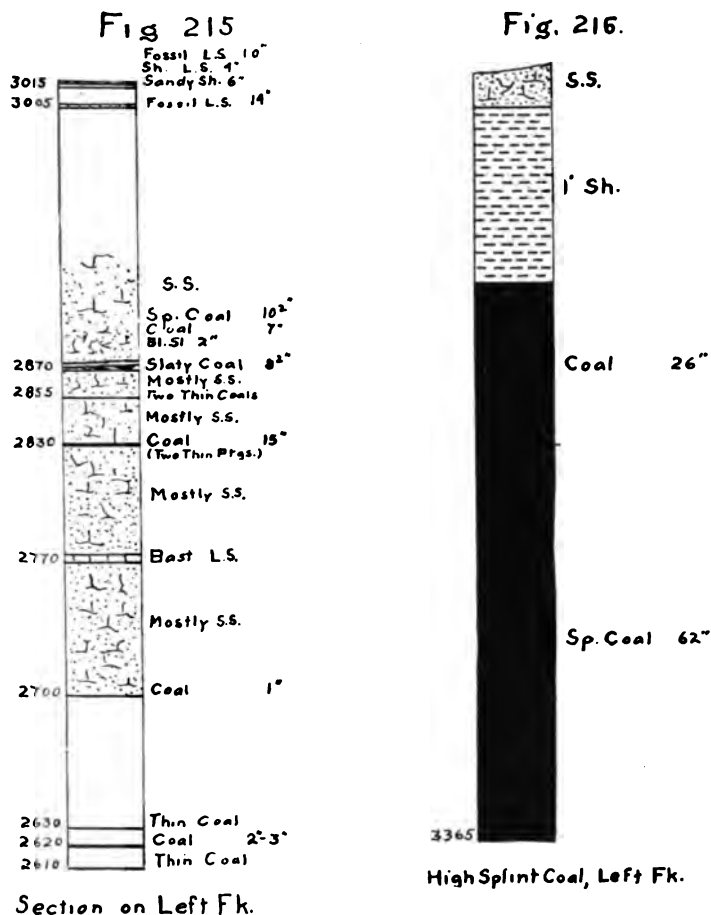
Rattlesnake Branch. On the left, $\frac{3}{4}$ mile up Left Fork.

In this branch, a half mile up it, 550 feet below Joshua Gilliam's house, the High Splint coal gives the thickness of figure 214. A foot or more of the splint seems to be bony, but is not likely to prove so.

From Mr. Thurston's notes of exposures along the Left fork up to the mouth of Levi Gap branch, $1\frac{1}{2}$ miles, the section of figure 215 is derived. Owing to the southeast dip of nearly 3 per cent. the intervals between strata are somewhat greater than the figure shows.

The fossil limestone is exposed in the bed of the creek. Its upper seam is rich in fossils, many unbroken, while in the remainder they are few and much comminuted.

At two miles up the left fork, in the left one of three forks, the High Splint bed gives the section of figure 216.



BIG LOONEY (OR LUNA) CREEK.

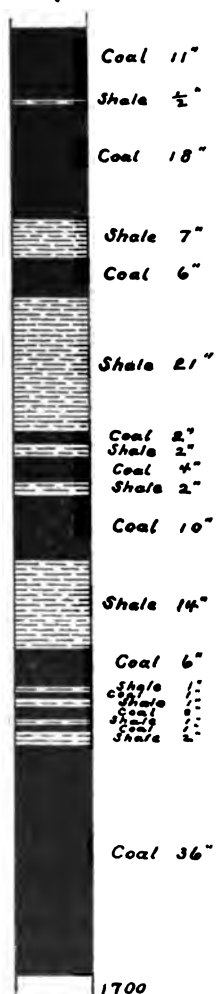
On the right, 22½ miles up Poor fork; elevation of mouth, 1535.

The Imboden bed, mined most extensively in Virginia between Big Stone Gap and Norton, is below drainage on this creek and on Clover Lick, but it must rise to surface close on the north of the mouths of these streams. Indication along Poor fork above and below them are not favorable to finding the bed in good condition in this vicinity.

On the right of the creek, $1\frac{1}{4}$ miles up, the Keokee coal is reported as in figure 217. Its elevation is more indicative of the Leonard bed.

Laurel Branch. On the right, $1\frac{1}{2}$ miles up Big Looney creek; elevation of mouth, 1580.

Fig. 218.



J. H. McKnight, Laurel Br.

Figure 218

represents the Harlan bed as found on the left $\frac{1}{4}$ mile up this branch. Of various measurements at hand that by Mr. Gardner, as the most recent, is selected for illustration. With eight partings amounting to $3\frac{1}{2}$ feet total, nearly one third of the coal under present mining practice would be abandoned, but by the time that it is brought into market it is likely to be too valuable to waste to such extent. Analysis of this coal and its coke are reported, and follow, but whether the sample taken was of all the coal, or of the bottom seam only, (36 inches thick where taken) was not stated.

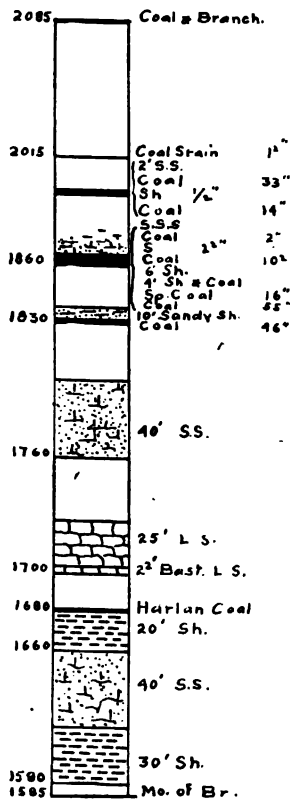
Fig 217



Keokee Coal, Gilliam.

HARLAN COAL.	Coal.	Coke.	[Coke.
Moisture.....			.80
Volatile matter.....	35.57	3.15	1.67
Fixed carbon.....	61.26	92.60	89.37
Ash.....	3.17	4.25	7.20
	100.00	100.00	99.04
Sulphur.....	1.06	1.10	.96
Phosphorus.....	.005	.012	.021

Fig. 219.



Section on Slick Rock Br.

The coke was said to be of good color, medium weight and fair structure, but not of best quality for big furnaces.

Slick-Rock Branch. On the left $15\frac{5}{8}$ miles up Big Looney creek; elevation of mouth, 1585.

The sandstone cliff prominent on the left in approaching this branch underlies the Harlan coal, and shows here, to some extent, the honeycomb structure prominent on Clover fork. Elsewhere on Poor fork, though often noticeable, it presents no such continuous cliff as is prominent here.

The Harlan bed has not been fully opened on this branch but its lower seam is reported 45 inches thick. Opportunity serves here to obtain accurate measure of intervals to the three beds opened above it. The section, figure 219, lies nearly along the synclinal axis, and on a steep slope so that no correction for dip is necessary.

The Leonard coal at elevation 1830 is of unusually good quality here for this bed, not only having a fine bright appearance, in part looking as if nearly cannel, but analyses also prove it superior. The following are, No. 2673 from sample collected by T. H. Morgan, No. 2885 from Mr. Thurston's sample, both analyzed by Dr. R. Peter for the Survey, and the unnumbered analysis of the coal and its coke from a private report.

LEONARD COAL.	No. 2673.	No. 2885.	Coal.	Coke.	Coke.
Moisture.....	2.50	2.20			.84
Volatile combustible matter.....	34.30	33.80	35.79	2.50	1.84
Fixed carbon.....	58.70	61.00	61.04	92.30	89.85
Ash.....	4.50	3.00	3.17	5.20	6.93
	100.00	100.00	100.00	100.00	99.46
Sulphur.....	.502	.552	.82	.72	.52
Phosphorus.....			.006	.010	.015
Color of ash.....	Brownish	Very light brown.			
Coke.....	Dense friable.	Dense spongy.			

No. 2673. "A much weathered sample".

No. 2885. "A pure-looking coal, mostly imperfectly laminated. Some surfaces brilliant and irregular; others dull, showing a little fine granular pyrites."

The coke is described as good color, weight and structure, similar to Dorchester, Va., coke, and adapted for big furnaces.

The Keokee coal at elevation 1860, figure 219, is in fine condition here also, with almost 6 feet of coal, in which the band of splint coal occupies the upper 16 inches.

Analyses of this coal follow as sampled and determined for the Survey like the next preceding, and of the average of two samples of coal and three of coke as given by two chemists in the same private report, their differences being slight.

KEOKEE COAL.	No. 2669.	No. 2886.	Coal.	Coke.
Moisture.....	3.40	5.70		
Volatile combustible matter.....	31.08	32.90	39.02	2.60
Fixed carbon.....	62.52	58.80	58.87	94.48
Ash.....	3.00	2.60	1.98	2.77
	100.00	100.00	99.87	99.85
Sulphur.....	.365	.425	.54	.443
Phosphorus.....			.02	.013
Color of ash.....	Light purple gray.	Very light brown.		
Coke.....	Friable	Light spongy.		

No. 2669. "A much weathered sample, containing a few pieces of bright hard coal."

No. 2886. "A pure-looking coal, breaking generally irregularly, with shining surfaces. Very little fibrous coal or pyrites apparent."

The coke was reported not of first-class, but of fair color, medium weight and structure.

The next bed, the McKnight, at elevation 1895, figure 219, is given its name because of its first discovery here as a bed of some importance on McKnight's land. It appears better at its opening than the following analysis of Mr. Thruston's sample by Dr. R. Peter indicates. The high percentages of ash and moisture are probably largely due to outcrop impurities, but the bed is not reliable here or elsewhere in this region.

MCKNIGHT COAL.		No. 2887.
Moisture.....		9.60
Volatile combustible matter.....		30.20
Fixed carbon.....		50.12
Ash..... (nearly white).....		10.08
		100.00
Sulphur.....		.560
Coke.....		Pulverulent.

From these openings into the Leonard, Keokee and McKnight beds, or from the three beds elsewhere in the vicinity, a trial was made of coke from a mixture of one-third each, from which the following analysis was reported:

		Coke.
Volatile matter.....		2.20
Fixed carbon.....		92.70
Ash.....		5.10
		100.00
Sulphur.....		.605
Phosphorus.....		.009

The coke was said to be of good color, weight and structure, not as heavy as Dorchester coke, but a working sample would be.

The higher coals of the section, figure 219, have not been opened, but both show promising stains. That one at elevation 2085, is on a distinct bench somewhat characteristic of the Low Splint bed, to which it doubtless belongs.

On the left, 2 miles up Big Looney creek, the Leonard, Keokee and McKnight beds are again opened, one above another, with coal as shown in figure 220. The Keokee has been driven some 10 yards under cover.

Mulberry Branch. On the right, $2\frac{1}{8}$ miles up Big Looney creek; elevation of mouth, 1645.

Figure 221 shows the Keokee coal as found on this branch by Mr. Thruston and sampled by him. Under number 2478 (b) is given Dr. Peter's analysis of the sample.

A recent measure of the bed, probably an adjacent opening, (Rebecca Creech) gave, as reported, 3 inches less coal and the parting increased to 13 inches. Analysis of this coal and its coke follow:—

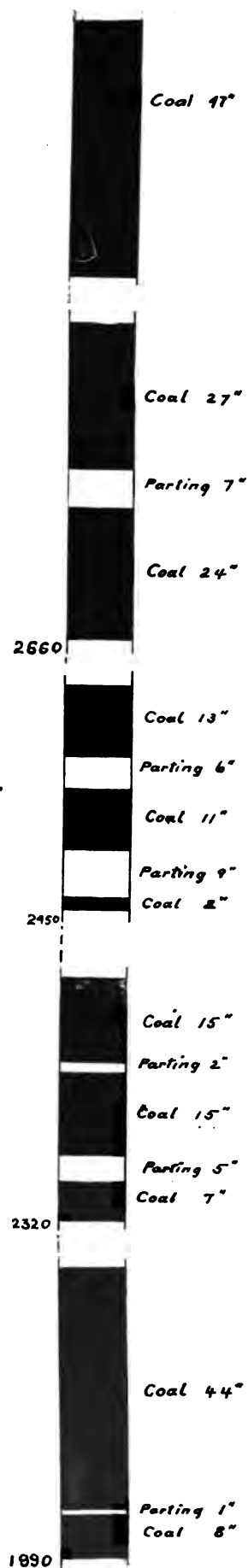
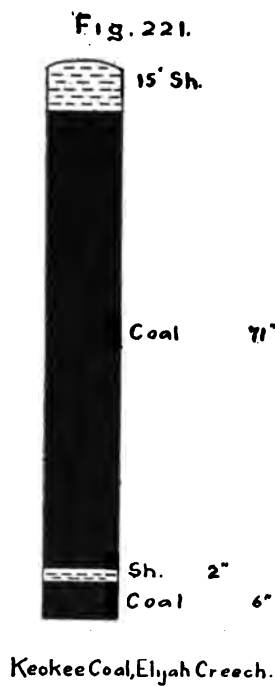
KEOKEE COAL.	2478 (b)	Coal.	Coke.
Moisture.....	1.46		
Volatile combustible matter.....	35.34	39.55	5.30
Fixed carbon.....	61.80	58.60	92.10
Ash.....	1.40	1.85	2.60
	100.00	100.00	100.00
Sulphur.....	.497	.63	.41
Phosphorus.....		.008	.007
Color of ash.....	Light pur- lish gray.		
Coke.....	Dense spongy.		
Specific gravity.....	1.198		

No. 2478 (b). "A bright pure-looking coal; of irregular cuboidal and lamellar fracture. Contains some little fibrous coal and a small quantity of fine granular pyrites between the irregular lamellae. Softens and swells somewhat in burning. Would doubtless make good coke."

The coke is stated to be of good color, medium weight and fair structure, similar to that obtained from the same bed on Slick-Rock branch.

Scott's Branch. On the right, $2\frac{1}{4}$ miles up Big Looney creek; elevation of mouth, 1665.

Six coal beds of some importance have been reported from this branch, but not the Keokee.



The lowest, on Jasper Creech land on the left of the branch, said to be of the Leonard bed, is the bottom coal of figure 222. No elevation was given.

On the right of the branch, Jasper Creech land, is the second coal of figure 222, supposed to be of the McKnight bed, but if so there must be an error of 100 feet or more in the elevation given as obtained by barometer. There is no reason to suspect such a rise of strata from other points in the vicinity as such height of this bed would indicate. Analysis of this coal and of its coke follow:—

MCKNIGHT (?) BED.	Coal.	Coke.
Volatile matter.....	37.05	2.90
Fixed carbon.....	55.05	89.40
Ash.....	7.90	7.70
	100.00	100.00
Sulphur.....	.82	.65
Phosphorus.....	.009	.011

The coke of good color and weight and good close structure. A heavy, first-class coke."

The third coal of the figure opened just above the second, is probably of the Low Splint bed, although its interval from the latter as obtained is somewhat large. The following analyses by two chemists are given of it.

LOW SPLINT (?) BED.	Coal.	Coal.	Coke.	Coke.
Moisture.....		1.23		.19
Volatile matter.....	38.10	37.73	4.10	.84
Fixed carbon.....	57.80	56.13	90.40	91.19
Ash.....	4.10	4.08	5.40	7.00
	100.00	99.17	99.90	99.22
Sulphur.....	.78	.83	.743	.78
Phosphorus.....	.006	Trace.	.006	.010

Coke of good color, fairly good weight and structure.

There is no regular bed of thick coal between the Low Splint and the Dean, but the third bed of figure 222, Elijah Creech land, 130 feet above the former and apparently intermediate, having been analyzed the results are given:

	Coal.	Coal.	Coke.	Coke.
Moisture		1.49		2.26
Volatile matter	36.25	33.51	1.85	.94
Fixed carbon	48.75	49.97	83.80	80.33
Ash	15.00	13.97	14.35	15.50
	100.00	98.94	100.00	99.03
Sulphur	1.127	1.06	.674	.97
Phosphorus	.012	.0215	.032	.012

Although of fair color, weight and structure, the coke is said to be dirty and not good. If of favorable thickness it would appear to be useful to mix with a light-ash coal for coke making.

The upper coal of figure 222, still on Elijah Creech land, appears to be of the Dean bed, but knowledge of its parting is needed for confirmation. If of the Dean it is the only point on Poor fork where it is known to be of workable thickness, little search for it having been made, and its quality here is unfavorable as the following analyses show, if the samples were taken clean.

DEAN (?) COAL.	Coal.	Coal.	Coke.	Coke.
Moisture		2.31		2.73
Volatile matter	36.55	34.36	4.00	1.96
Fixed carbon	52.60	52.00	77.70	73.75
Ash	10.85	10.50	18.30	20.30
	100.00	99.17	100.00	98.74
Sulphur	1.104	.83	1.12	1.26
Phosphorus	.020	.024	.018	.014

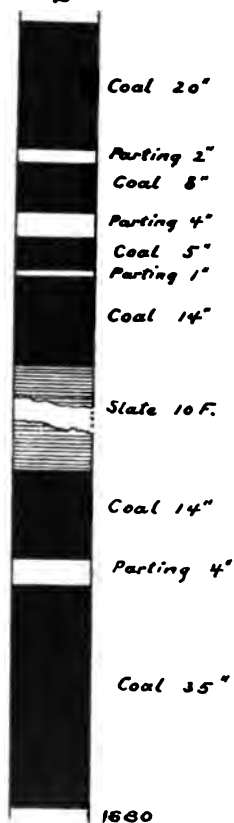
Coke not good, dirty.

The sixth opening, not figured, is reported of the High Splint bed, with 47 inches of coal without parting, and yielding the following analyses:

HIGH SPLINT (?) COAL.	Coal.	Coke.
Volatile matter	42.00	4.65
Fixed carbon	54.60	90.90
Ash	3.40	4.45
	100.00	100.00
Sulphur	4.95	.481
Phosphorus	.011	.008

The coke is said to be not good, dirty and fragile.

Fig. 223.



Harlan Coal, Blair Heirs.

splint, and associate beds.

Big Branch. On the left, $3\frac{3}{4}$ miles up Big Looney creek; elevation of mouth, 1790.

Of the two coals shown in figure 225 the lower one appears to be of the Leonard bed. It is opened in an entry back of the Blair house, a hard rich looking pitch black coal with a knife-edge parting 3 inches from the bottom.

Figure 223 shows the reported condition of the Harlan bed just before it goes under Big Looney creek, opposite the mouth of Maggard, $2\frac{1}{2}$ miles from Poor fork. When visited the partly covered opening showed, in a 5-yard entry, an inch of shale near the middle of each of the two lower seams of coal, but other partings were somewhat thinner at the face than at the mouth of the entry.

Back of this opening, on the top of Looney ridge, the fossil limestone is exposed 1230 feet above the Harlan coal. With strata nearly horizontal this gives the interval nearly correctly.

Rice Branch. On the left, assumed 3 miles up Big Looney creek; and elevation of mouth 1730.

The coals of figure 224 were found by Mr. Thruston along Rice branch, up which they rise, so that he estimated their actual distances apart possibly not more than half that shown in the figure. With such allowance they may well represent the Keokee (with its band of

Fig. 224.

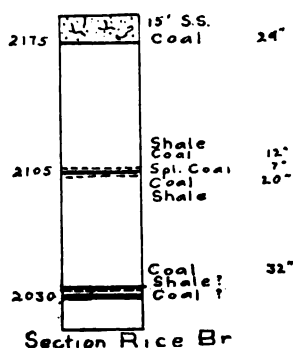
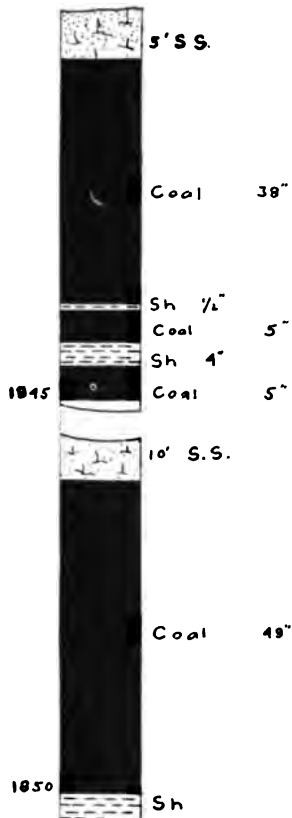


Fig. 225.



Chas Blair

accounted for only by the presence of two beds of fossil limestone, or by a slip for 100 feet or more of limestone and accompanying shale in mass. There are two beds on the left fork of Straight creek, Bell county, 80 feet apart, but the presence of both here remains to be proven.

On the right, $4\frac{1}{2}$ miles up Big Looney creek, just above its level, the

The upper coal of the figure opened farther up the branch is probably of the McKnight bed, but a rise of strata up the branch may bring it to the Keokee level.

On the right of Big Looney creek, opposite the Charles Blair house, the Keokee, or possibly Leonard, bed has the following section:

10' Shale.	
Coal.....	36"
Shale.....	4"
Coal.....	12"
20' Sandstone.	El. 1870

On the Blair tract, on the left, $3\frac{3}{4}$ miles up Big Looney creek, fossil limestone lies at elevation 2835, not over 960 feet above the Keokee, whereas below on Big Looney creek and on the head of Clover fork the interval between the two was found to be about 1050 and 1100 feet. The barometer readings having been checked the discrepancy can be

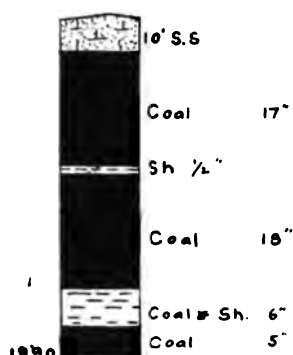
Fig. 226.



Keokee Coal, J. Blair.

Keokee bed gives the section of figure 226. There is, however, in the long exposure of the bed there a variation of thickness of the upper seam of coal from 59 to 65 inches and of parting from 3 inches to none. Above the coal is a sandstone cliff with shale between varying from $1\frac{1}{2}$ feet to none.

Fig. 227.



Thomas Blair

On this branch below the Anthony Blair house floating cannel coal was found 400 feet above its mouth and about the same above the Keokee coal. It is the only cannel coal known to have been discovered on Poor fork waters east of Clover Lick creek. Blocks of it 6 inches thick were found, but the thickness of bed or its location are not known.

Barnet Branch. On the left, $6\frac{1}{2}$ miles up big Looney creek; elevation of mouth 2190. The mail route follows this branch.

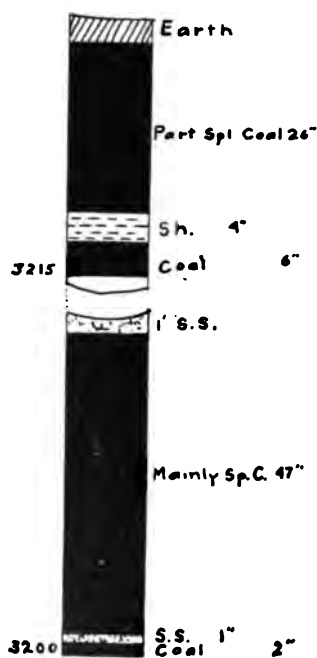
The coals of figure 228 were opened on this branch $\frac{1}{4}$ mile west of the post-trail. The lower one is identified as of the High Splint bed by its sandstone parting, which appears

Gap Branch. On the right, 5 miles up Big Looney creek; elevation of mouth, 1955.

Figure 227 represents the Keokee bed, (or possibly McKnight) at the last point where these beds have been found before going below drainage. The opening is on the right $\frac{1}{4}$ mile up Gap branch.

Sugar Camp Hollow.—On the left, $5\frac{3}{4}$ (?) miles up Big Looney creek; elevation of mouth, 2070?.

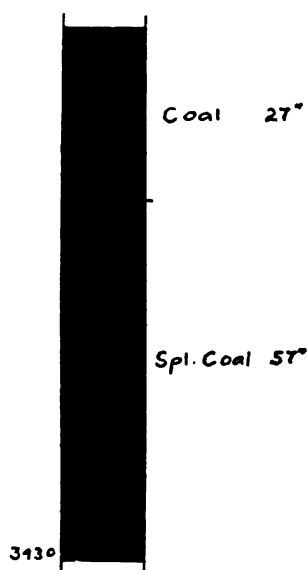
Fig 228



Barnet Br.

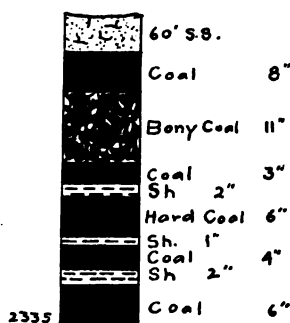
again at an opening in Fickle Cove, a mile or more south of this one. According to elevations obtained this is 300 feet lower than that, and but about 1250 above the Keokee coal at the mouth of Gap branch, whereas in both cases it should be expected to be about 200 feet higher. It is therefore

Fig. 229.



High Splint Coal, Right Fk.

Fig. 230



Low Splint Coal.

probable that the elevations given for these high coals are incorrect to some such extent. They were taken by barometer with a heavy thunder-storm approaching.

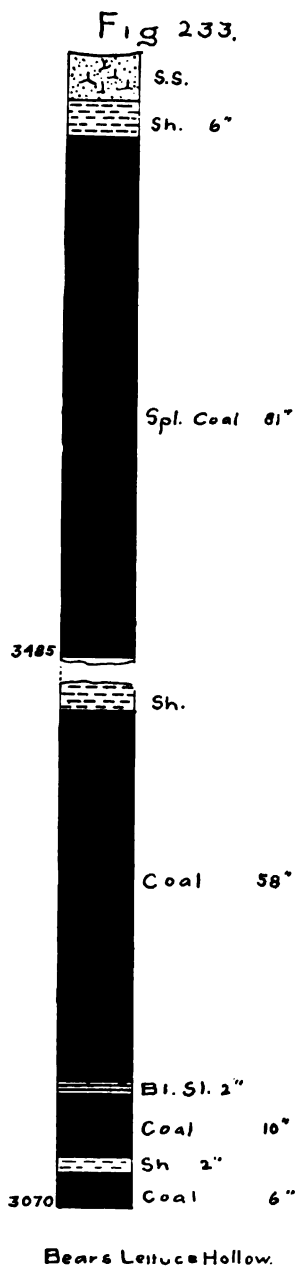
Their elevations were obtained from the top of Big Black mountain at the McHenry fields, elevation there, 3840. The 32 inches coal above the main seam is probably an offshoot from the latter.

Right Fork. On the right, 7 miles up Big Looney creek, elevation of mouth, 2270.

The fossil limestone shows at water level, $1\frac{1}{4}$ miles up the fork at elevation 3015, in shale with a thin coal 5 feet under it.

Five openings have been made on this stream into the High Splint coal, the least of which, in the point of the spur on the right, $\frac{1}{2}$ mile up, gave 60 inches of clean coal, with probability of more, as the opening was unfinished. The best of them on the right, $1\frac{3}{4}$ miles up, $\frac{3}{4}$ mile north of the highest point on Big Black mountain, gave the coal of figure 229.

The northwest dip across the fork and on the main heads of Big Looney creek is slightly over 3 per cent.

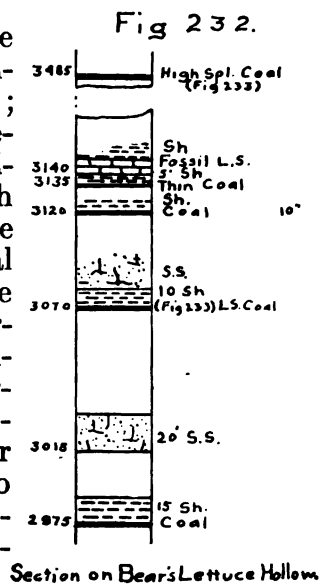


intervals nearly right. The Joe Jenkins house across the main stream is at elevation 2610.

The Limestone coal, in the branch at elevation 3070, was sampled for the Survey by Prof. A. R. Crandall before the bed was opened sufficiently to develop the lower parting. Otherwise, probably the amount of ash would have been less in the following analysis of his sample by Dr. R. Peter.

LIMESTONE COAL BED. No. 2863.	
Moisture.....	3.00
Volatile combustible matter.....	31.40
Fixed carbon.....	56.30
Ash (light buff-gray).....	9.30
	100.00
Sulphur.....	.604
Coke.....	Dense.

"A pure looking pitch-black coal; generally irregularly laminated, with some little fibrous coal between the laminae. Portions breaking irregularly, with shining irregular surfaces. No pyrites apparent in the sample."



The fossil limestone, by the side of the branch 70 feet higher, has its usual characteristics, unmistakable on the heads of Big Looney creek, and generally elsewhere.

The Stain of the High Splint bed shows at the head of the branch, between sandstones, 80 feet under the end of the long level top of little Fork ridge. The upper coal of figure 233 shows this bed as it was opened on the next branch below, 150 to 200 yards west.

Fickle Cove. On the left, $7\frac{7}{8}$ miles up Big Looney creek.

The section of figure 234, taken along the southern side of the cove, shows the strata above the limestone with somewhat exaggerated intervals. The Limestone coal at the bottom, 525 feet above the Joe Jenkins house and 75 feet under the fossil limestone, is here probably about 4 feet thick, apparently without parting. In several places attempts to open were frustrated by large rocks broken from the sandstone above.

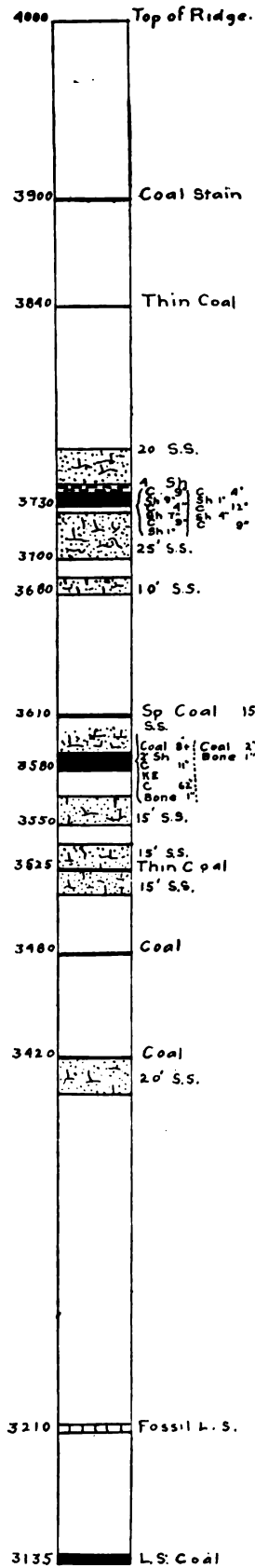
The fossil limestone was found in an open field where ploughing had scattered much besides that exposed in place.

The High Splint coal is shown at elevation 3580. This early opening was made 70 feet above two large rocks by the path to the mountain top and some 20 yards to the right of the path. All signs of the opening are now obliterated.

Samples of this coal, with measurements differing slightly, were obtained, No. 2672, by Mr. Morgan, assistant to Mr. Thruston, and No. 2882, of 5 feet of the coal, by Mr. Thruston, both of which were analyzed by Dr. R. Peter with the result following:

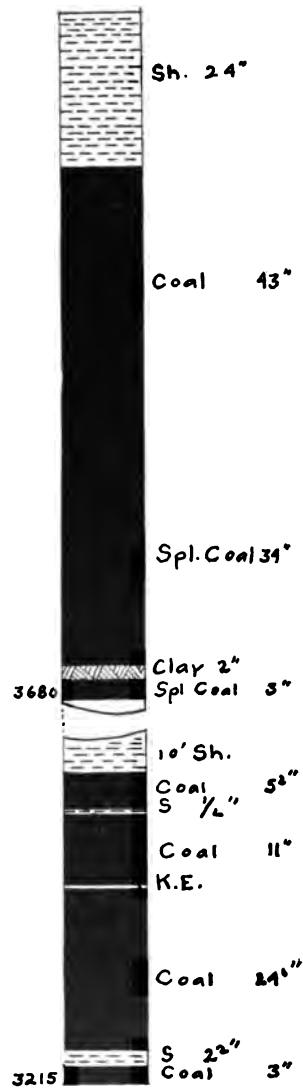
HIGH SPLINT COAL.	No. 2672.	No. 2882.
Moisture.....	2.30	1.90
Volatile combustible matter.....	33.30	28.90
Fixed carbon.....	57.20	61.10
Ash.....	7.20	8.10
	100.00	100.00
Sulphur.....	.502	.486
Color of ash.....	Brown.	Light gray-brown.
Coke.....	Dense.	Spongy.

Fig. 234.



Section on Fickle Cove

Fig 235



Camp Fork.

No. 2672. "A weathered sample."

No. 2882. "Somewhat weathered, and partly in a powdered condition. Some portions dull-black."

A recent opening of the bed was made on the north side of the cove, in which is 53 inches of coal, partly splint, without parting, elevation, 3560.

The coals shown above the High Splint bed in figure 234 are of little importance, though that one at elevation 3730, has been found frequently, about 150 feet above the High Splint, some 5 thick, but always ribbed with ruinous partings.

Camp Fork. On the left, $8\frac{1}{8}$ miles up Big Looney creek; elevation of mouth, 2590.

Figure 235 shows, in its lower coal, the Limestone coal as found by Mr. Thruston on the Right fork. His sample of the coal analyzed by Dr. R. Peter gave the following results:

LIMESTONE COAL.		No 2883.
Moisture.....		3.20
Volatile combustible matter		28.06
Fixed carbon		60.44
Ash (light brown)		8.30
		100.00
Sulphur.....		0.541
Coke	Dense friable	

"Sample somewhat weathered; partly pulverized."

What is probably of the same bed, was found by Mr. Morgan on the Left (or Trace) fork, with 51 inches of coal without parting, under eight feet of shale. But if it is the Limestone coal, the elevation he obtained for it, 3420, is fully 200 feet too high.

The upper coal of figure 235 is of the High Splint bed as opened on the Right fork. A recent opening on the Left fork, 40 feet lower, gave 82 inches of coal without parting, and in an early opening on the same fork, now disappeared, Mr. Morgan measured 87 inches without parting.

What may be the Cornett bed he found 60 feet lower with 29 inches of clean coal.

FICKLE COVE.

FICKLE RIDGE.

CAMP FK. DRAINAGE.

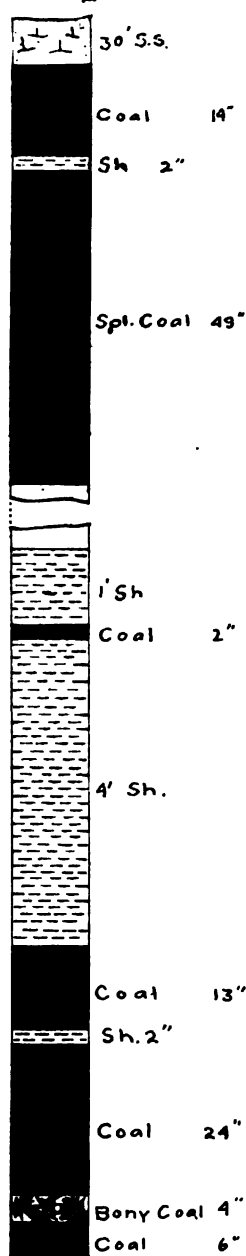
PL. IV



GILLIAM RIDGE.

HEAD OF CAMP FORK OF BIG LOONEY.

Fig. 236.



Rockhouse Fork.

Across the mountain from Left Fork, on the north side of Isom Rock spur the High Splint bed has 83 inches of coal. It continues rising south-eastward to its outcrop on top of the spur at elevation 3705.

South of the spur the bed has but 72 inches of coal. It lies but 50 feet under the low gap at the head of the middle fork of Camp Fork.

Rockhouse Fork. On the right, $8\frac{3}{4}$ miles up Big Looney creek, elevation of mouth, 2900.

The lower coal of figure 236 is of the Limestone coal, as opened on the right of the fork. At the path on the left a second opening, 10 feet lower, gave 44 inches coal without parting.

On the left of the fork, by the path, at elevation 3700, the High Splint bed, under cover, has 82 inches of clean coal, most of which is splint.

In Kettle rock house, 70 feet below the gap to Little Looney creek, the same bed has, at the mouth of an 8-yard entry made since the measurement was taken, the section of the upper coal of figure 236. Outcrop coal from this place sampled by Mr. Thruston and analyzed by Dr. R. Peter gave the results following under number 2884. The coal was also sampled by the U. S. Geological Survey at the face of the entry and a car sample was taken preliminary to testing the coal at the St. Louis testing plant, for the owner, the Inter-

State Investment Company. The resultant analyses are given under numbers 2272 and 2528, respectively:

HIGH SPLINT COAL.	No. 2884.	No. 2272.	No. 2528.
Moisture.....	2.10	4.72	4.36
Volatile matter.....	32.90	35.74	35.02
Fixed carbon.....	56.60	57.06	56.92
Ash.....	8.40	2.48	3.70
	100.00	100.00	100.00
Sulphur.....	.774	.54	.67

No. 2884. "A pure looking coal, generally. Some portions imperfectly laminated, with some little granular pyrites and fibrous coal apparent; other portions breaking irregularly, with shining irregular surfaces."

Analyses of the coal for the several tests at the testing plant resulted in the following:

HIGH SPLINT COAL.	Steaming.		Gas.	Coking.	
				Coal.	Coke.
Moisture.....	4.72	5.40	3.75	4.67	0.30
Volatile matter.....	34.96	34.57	36.05	35.33	1.21
Fixed carbon.....	56.57	56.06	56.17	56.30	93.26
Ash.....	3.75	3.97	4.03	3.70	5.23
	100.00	100.00	100.00	100.00	100.00
Sulphur.....	.48	.63	0.47	.45	.41

Of the sixty-four coals tested during the eight months covered by the report this coal stands among the highest for steaming purposes and as a gas producer, and of those tested for coke, while some gave a higher yield of coke, the additional percentage is almost invariably due to a greater proportion of ash, and as no others have so little sulphur, this High Splint coal on the whole is probably the best coking coal of those tested.

The coke produced amounted to 66.61 per cent. and of breeze 2.13 per cent. The coke is described as "Light gray and silvery. Fine heavy coke. High yield due to deposited carbon."

GILLIAM RIDGE.

ROCKHOUSE PK.

ROCKHOUSE RIDGE.

PL. V.



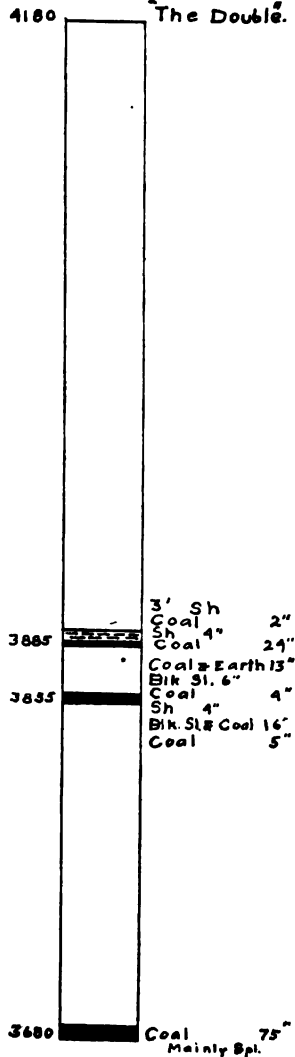
HEAD OF BIG LOONEY.

For full details of the tests reference is made to the U. S. Geological Survey, Bulletin No. 290, pages 123 to 125.

On the south side of the mountain the High Splint bed is opened, at elevation 3725, with 69 inches of coal, of which

Fig. 237. the lower 38 inches is splint.

4180 The Double.



Section at Main Head.

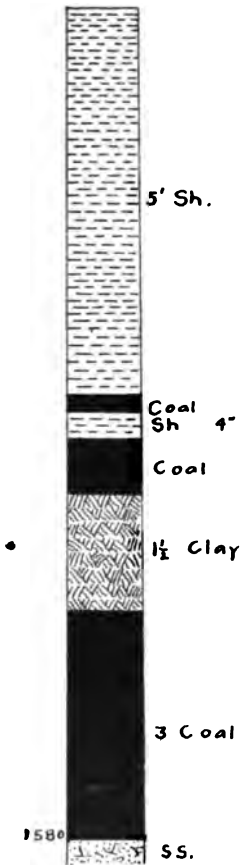
In figure 237 are represented the High Splint and beds above it found directly under and north of the junction of Big and Little Black mountains.

Two other openings were made into the High Splint bed between the main head and Cherry fork, on the right, giving 75 and 65 inches of coal, the latter not fully developed. An opening on the south side of the mountain, on the head of the Left fork of Little Looney creek, at elevation 3725, is the highest made into this bed: The coal there is 74 inches thick.

Plate V shows the mountain at the head of Big Looney Creek, with the gap to Little Looney creek near its center, 70 feet below which is the High Splint coal. The dip carries the coal well down the spur toward Fickle cove shown on the left, and also down those on the right, from one of which the photograph was taken.

By the road on the left of Poor fork, $23\frac{3}{4}$ miles up and 20 feet above it, ($1\frac{1}{4}$ miles above Big Looney creek) is the coal of figure 238. It was not opened so that its main seam could be measured more than approximately, nor could its character be judged. With a strong south-

Fig. 238



W.G. Blair

east pitch it is carried farther under the Harlan coal, outcropping at an elevation of perhaps 1750 in the river hills on the right, than can now be determined, but it is not unreasonable to suppose that this may be the Imboden, bed, some 300 feet below the Harlan.

Wilson Creech Hollow.

On the right, 25 miles up Poor fork; elevation of mouth, 1570.

In this hollow Mr. Gardner found the coal of figure 239, supposed to be of the Keokee bed, though apparently rather high for it.

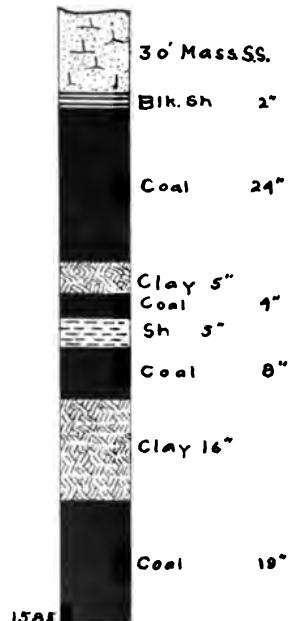
On the left, at the ford, 25 miles up Poor fork, 10 feet above it, some coal has been taken out for local use from a bed with the section of figure 240. Under this some 20 feet is 14

Fig. 239.

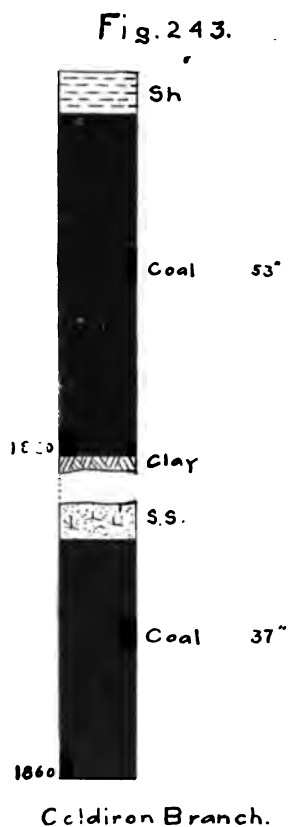


Wilson Creech.

Fig. 240.



Elijah Holcomb.



including the lower 6 inches, callep bone coal, but, in view of the low ash of the analysis more likely splint coal. Number 2889 is of the upper Keokee bed.

LEONARD AND KEOKEE BEDS.	No. 2888.	No. 2889.
Moisture.....	1.80	2.40
Volatile combustible matter ..	31.60	31.70
Fixed carbon	63.20	63.70
Ash (light brown).....	3.40	2.20
	100.00	100.00
Sulphur.....	1.181	0.312
	Light spongy.	Dense spongy.

No. 2888. "A good-looking coal. Mostly lamellar in structure. Portions breaking irregularly, with irregular shining surfaces. Some little granular pyrites and fibrous coal apparent in the sample."

No. 2889 "Generally a fine-looking coal. Breaking with irregular, shining surfaces. Some portions laminated. and more dull in appearance, with some little fine granular pyrites apparent."

EVERSOLE BRANCH.

On the right, 29 miles up Poor fork; elevation of mouth, 1625. The coal of figure 244, found by Mr. Gardner $\frac{1}{2}$ mile up this branch, with very slight dip, appears to be on the level of the Keokee bed, but the Leonard must be found to determine the correlation.

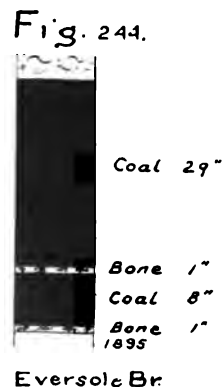
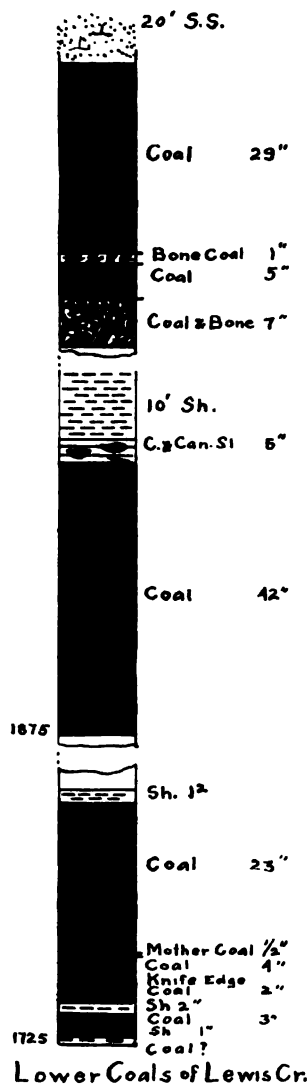


Fig 245

LEWIS CREEK.



On the right, 30 miles up Poor fork; elevation of mouth, 1650. The lower coal of figure 245 is, with little doubt, of the Harlan bed. It was opened in the bed of a left branch, $\frac{1}{2}$ mile up the creek, and considerable coal for local use taken from it. The coal was reported about 5 feet thick, but the pit was so far filled when visited that only that part shown in the figure was proven.

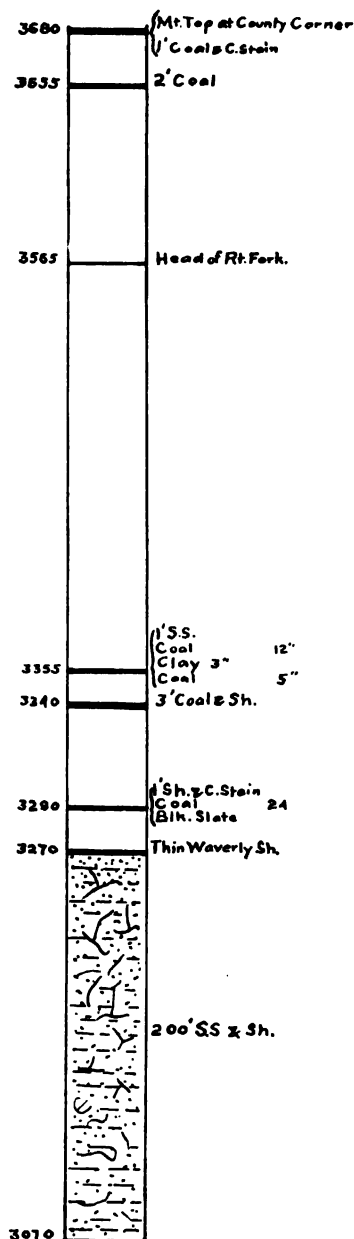
What appears to be the Keokee bed was found on the right, $\frac{3}{4}$ mile up the creek, with but 33 inches of coal, somewhat bony toward the bottom, a sandstone floor; elevation 1900.

The middle coal of the figure, found $1\frac{1}{4}$ miles up the main creek, is supposed to be of the Leonard bed, and the upper coal, $\frac{1}{4}$ mile up the Left fork, of the Keokee bed. At $\frac{1}{4}$ mile up the Right fork the two beds appear again, the lower with 36 inches of coal, the lower 6 inches possibly bone, elevation 1895; and the Keokee with 30 inches of coal and again a sandstone floor; elevation 1960.

The section of Fig. 246 shows a group of coals opened on the Left fork, and two beds but partly opened on the mountain top at the Harlan-Letcher county corner.

The three lower coals, $\frac{1}{4}$ mile up to the right of the

Fig 246



Section at Head of Lewis Cr.

path, were reported traced from the High Splint coal and adjacent beds on Barnet branch, Big Looney creek, and in view of the great thickness of barren rocks under them, it is little likely that error was made in so doing. Such being the case the bed is conspicuous in thickness and quality only so far east as the Harlan-Letcher county line. Though worthless on Lewis creek, it becomes of some value again still farther east.

Pebbles were found along the mountain top from elevations 3565, the head of the Right fork, to 3675, which is rather indicative of the High Splint at a much higher level than supposed, but no coal was found to answer for it.

A 3-foot bed of coal and clay was opened 100 yards north-east of the house at the county corner on the top of the mountain, elevation 3655 and 25 feet higher, level with the house is a coal stain over 1 foot thick.

At Joseph Jenkins', on the right, $31\frac{1}{4}$ miles up Poor fork, the following coals were found:

Clay.....		
Coal.....	3"	
Clay.....	12"	
Coal.....	24"	El., 1770.
Clay.....	15"	S. E. dip, slight.
Coal.....	4"	
Coal.....	36"+	
Parting.....	6"+	El., 1700.
Coal.....	12"+	S. E. dip, 10° ±
Earth.....		
Black slate.....	6"	
Coal stain.....	3"	
Clay.....	16"	
Coal.....	17"	
Clay.....	9"	El., 1680.
Coal.....	15"	S. E. dip, 20° ±
Clay.....	1"	
Coal.....	3"	
Sandstone.....		

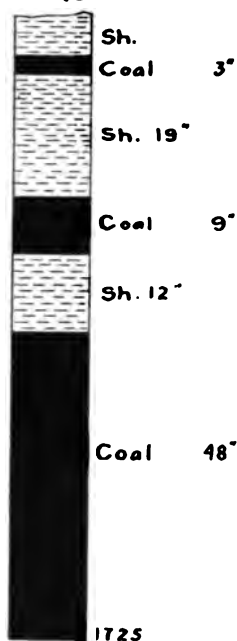
The lowest of these coals was opened in front of Mr. Jenkins' house, on top of the 15 feet or more cliff-rock at Poor fork. The middle coal in pits filled with water $\frac{1}{8}$ mile southwest of the house. (Numerous pebbles were dug up in the sandy soil covering the coal.) The upper coal was opened by the old road, $\frac{1}{8}$ mile east of the house. In the latter the coal of the main seam, in part splint, was, much of it, heavy with impurities, rather indicative of unusual thickening.

Supposing the lowest coal found on Lewis creek (in a left branch, $\frac{1}{2}$ mile up) to be the Harlan coal, the following gives the relation of the four beds to each other, as nearly as could be estimated by eye.

Harlan coal.
Interval, 150 feet.
Coal at elevation 1770.
Interval 90 feet.
Coal at elevation 1700.
Interval 40.
Coal at elevation 1680.

This gives the interval between the Harlan and bottom coal about 280 feet, but it may quite possibly be 100 feet more, and, with the hard sandstone below the bottom coal the latter one is most likely to prove of the Imboden bed, extensively mined opposite on the south of Big Black

Fig. 247.



Meadow Br.

They seem to lie directly under the level of the Harlan coal.

mountain. The opening here is not so located as to be likely to give the normal thickness for this locality.

The next bed above it then corresponds with the Kelly bed, which reaches a maximum thickness of about 7 feet between Big Stone Gap and Norton.

MEADOW BRANCH.

On the right, $31\frac{5}{8}$ miles up Poor fork; elevation of mouth, 1665.

The coal of figure 247, with 5° dip, measured by Mr. Thruston, is at stream level $\frac{1}{4}$ mile up and on the Left fork. It is clearly of the Harlan bed, and the peculiar topography, elsewhere noted as sometimes accompanying this coal, shows itself in the long spurs and knobs between the forks of this branch.

Pebbles are abundant at and near elevation 1780, on one of the knobs between the forks of the Right fork.

COLLIER CREEK.

On the right, $31\frac{3}{4}$ miles up Poor fork, elevation of mouth, 1665.

In the cliff on the left, $\frac{1}{4}$ mile up this creek, at creek level, 1675, is a hard coal 8 inches thick, with 5 feet of black shale covering under 4 feet of brown shale. Then 11 inches more coal, at elevation 1685, with sandstone to the fire-clay floor of the bottom coal of figure 248, which is of the Harlan bed, opened by the roadside to about 3 yards underground when last visited.

Fig. 248.



Lower Coals on Colliers Cr.

The Low Splint bed has been opened on the Rebecca Creech land, $\frac{1}{4}$ mile up a right branch, $\frac{3}{4}$ mile up the creek, with the following section:

Ft.	In.
5	Sandstone.....
	Coal..... 21
	Shale..... 3"
	Coal..... 12
Elevation, 2125	

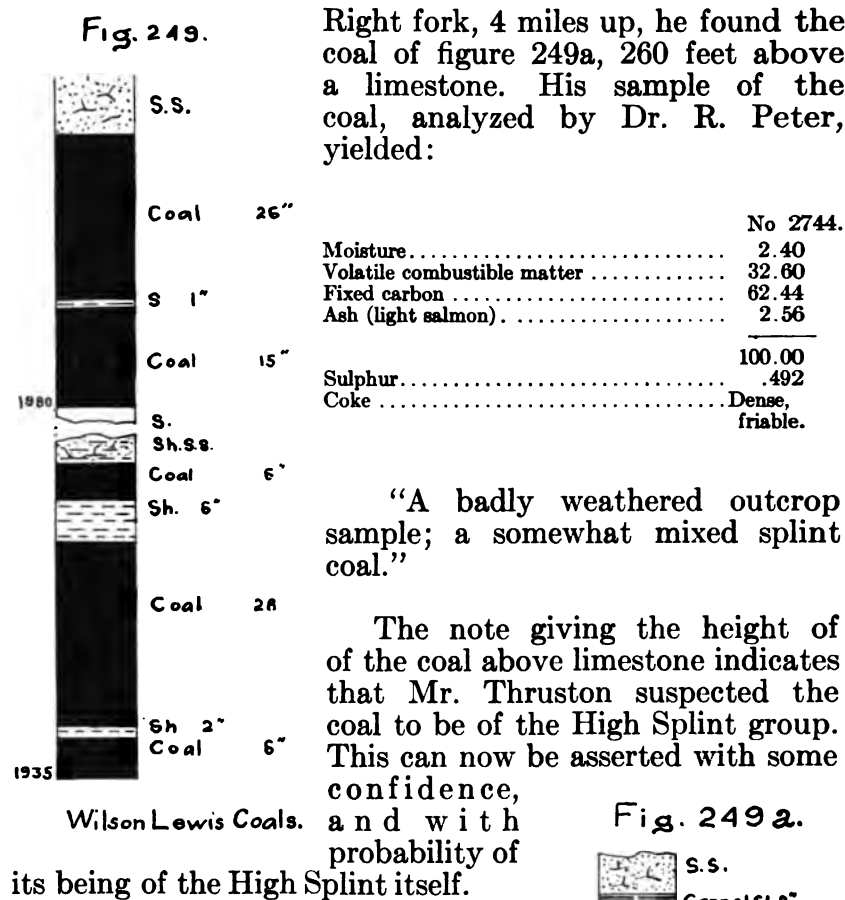
The bottom coal was partly hidden when visited, but the full thickness of bed is probably not over $3\frac{1}{2}$ feet.

On the left, at the forks a mile up, the Keokee coal is about 4 feet thick, with sandstone roof, elevation 1880. Between the forks the Leonard coal shows 25 inches thick with shaly sandstone roof, elevation 1875. Thirty feet over this exposure the Keokee bed is opened as in the middle coal of figure 248, a part of the coal a handsome splint.

On the left $\frac{3}{8}$ mile up the main, or Right fork, on Wentz land, the Low Splint bed has the section of the upper coal of the figure, the bottom coal approximate only, as it was covered when visited.

The two coals given in figure 249, found by Mr. Thruston on Wilson Lewis land on the Right fork, seem to be of the Leonard and Keokee beds. Opposite the former a single seam only 29 inches thick was also found.

On a right branch of the

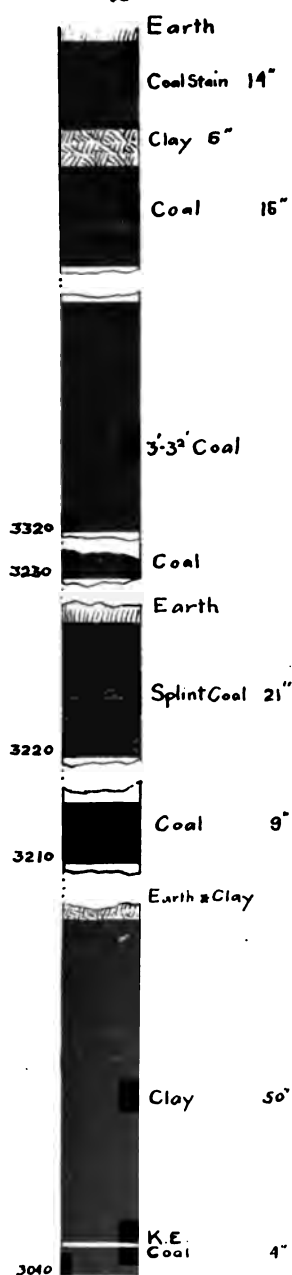


In figure 250 are given the coals found on the Middle fork with the Limestone coal at the bottom not fully opened, but apparently little over 2 feet thick.

Fossil limestone, evidently nearly in place where found, is 100 feet nearer to the High Splint coal than it is on Big Looney creek, if the



Fig 250



Section on Middle Fk

bed at elevation 3040, reproduced in figure 251, is of the High Splint, as it is supposed to be.

Of the higher coals, that at elevation 3220 is a very hard splint. That at 3230, thin seams which may have slipped

down from a higher level. That at 3320, part hard and part impure; an unattractive bed. The imperfectly opened top coal (under an easterly gap of this fork) has for its lower seam a light gray splint coal of very light weight. It is 25 feet higher than the most western gap of the Middle fork.

On the Left fork, what appears to be the High Splint bed was found with 37 inches of coal and 2 inches parting at elevation 3110; and 25 feet higher is 29 inches of coal, partly splint. Gibson gap (to Mud Lick) has an elevation of 3470.

SUGAR CAMP BRANCH.

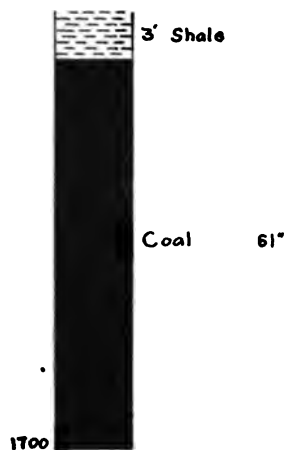
On the right 32½ miles up Poor fork; elevation of mouth 1670.

The Harlan coal is opened on the left of this branch in an

Fig 251



Fig. 252.



Harlan Coal, David C. Mullins.

8-yard entry with 61 inches of coal at its mouth. A thin seam of coal shows 3 feet above the main bed under 15 feet more of shale, but this coal diminishes rapidly in going up the branch.

DAVID MAGGARD BRANCH.

On the right, $32\frac{3}{4}$ miles up Poor fork; elevation of mouth, 1675.

An incomplete opening, 25 feet above the mouth of the branch, gave 34 inches of coal under 2 feet of yellow shale. With

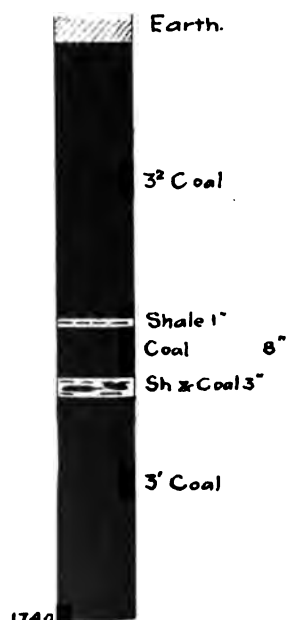
a dip of nearly 30 degrees,

decreasing to but slight dip $\frac{1}{4}$ mile up the branch, it is carried far under the Harlan coal, opened at the latter point in an 8-yard entry. Figure 253 shows the bed-section there as nearly as it could be ascertained in its abandoned condition.

A 15-inch coal seam lies about 30 feet under the main bed, and another thin seam with black slate roof 15 feet below that.

Just above Maggard branch, on the left of Poor fork and the road where the latter is well up on the hillside, thin bedded sandstone shows where it is judged to be 75 to 100 feet below the level of the Harlan coal. Unimportant, it still tends to confirm the impression of the prevalence of such sandstone at this horizon.

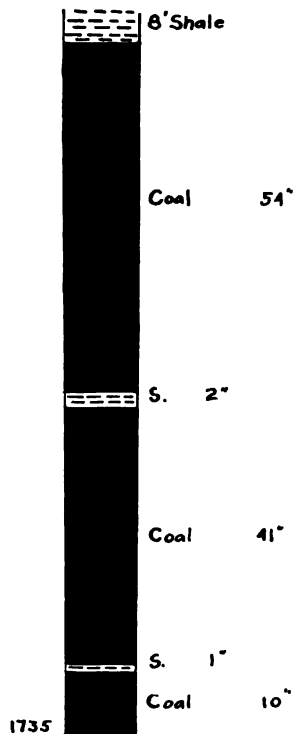
Fig. 253.



Harlan Coal, David Maggan.

Fig. 254.

ROBERTS BRANCH.



On the right 34 miles up Poor fork; elevation of mouth, 1685.

The only opening known on this branch is of the Harlan bed, opened on the left, $\frac{1}{8}$ mile up. Partly covered when last visited. Mr. Thruston's measurements of the bed are given in figure 254. Dr. R. Peter's analyses of his sample of the coal, number 2745, and 72-hour coke made from it at Quinnimont, West Virginia, number 2746, follow. They were formerly reported as Wilson Lewis coal and coke from Roland's Branch.

HARLAN COAL.		No. 2745.	No. 2746.
Moisture.....		1.40	0.70
Volatile combustible matter ..		33.40	
Fixed carbon		59.08	89.30
Ash		6.12	10.00
		100.00	100.00
Sulphur.....		1.426	.863
Color of ash.....		Light gray	
Coke		Spongy.	

Harlan Coal, HD Raleigh.

The coal sample was "dirty and weathered" and tests from well underground would doubtless show better results for both coal and coke.

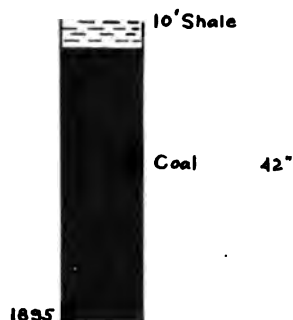
A 6-inch coal lies 20 feet under the main bed.

On the point of a spur of Pine mountain, in the road north of the mouth of Roberts Branch, is what appears to be an outcrop a foot or more thick of soft pebble conglomerate, but whether actually rock in place or the remains of a disintegrated boulder was not determined. Above the road small hard conglomerate boulders were found, which seemed to belong to the same horizon. Giving stronger evidence of the nearness of the conglomerate to the Harlan bed than the scattered pebbles found elsewhere close under the bed's position, and with a good opportunity for estima-

tion of interval, the distance from the Harlan opening on Roberts Branch to the road was measured and pitch of exposed strata taken, from which the profile of figure 255 was derived. From this figure it is found that the interval from the Harlan bed to the conglomerate is about 250 feet, 100 feet or more above the Imboden bed. If such is the case the hard sandstone found everywhere not far below the Harlan bed is close upon the true top of the Conglomerate formation and that coal is the No. 1 of the counties farther north.

Fig. 256.

STAGGER-WEED HOLLOW.



Wilson Creech.

On the right $34\frac{1}{2}$ miles up Poor fork; elevation of mouth, 1690.

The Leonard bed shows by the branch, at elevation 1835, a splinty coal 25 inches thick with shale roof.

The Keokee bed is opened in the Wilson Creech 10-yard entry, on the left $\frac{3}{8}$ mile up, a fine-looking 42-inch coal as in figure 256.

Cannel coal was found in a slip at elevation 2120, 580 feet below the gap to Collier creek.

Above Stagger-weed hollow the Harlan coal has blackened the soil of the Poor fork bottom, and reaches across into the foot of Pine mountain, by the road-side. What are perhaps the Imboden and Kelly beds show, at several points along the Poor fork road, only thin coal in strata much warped. The two beds reach heights of 150 and 325 feet above stream in the road from Partridge Post-office over Pine mountain. The road gap is 900 feet above Poor fork.

Where that road starts its ascent after rising over about 35 feet of hard sandstone it cuts into 3 feet of very soft sandstone and then 3 feet of blue shale with more soft sandstone above it. Loose pebbles were found that apparently came from between the shale and sandstone below it, but none were discovered actually imbedded in the rock. They should be considered as having drifted there but that in a

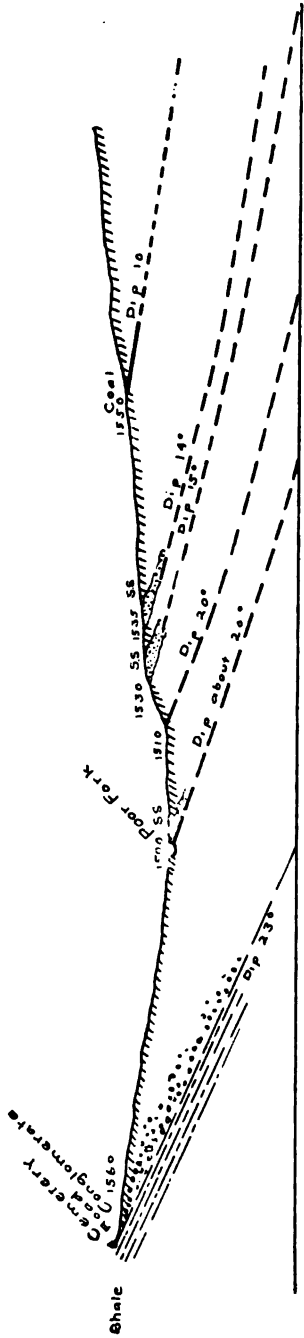


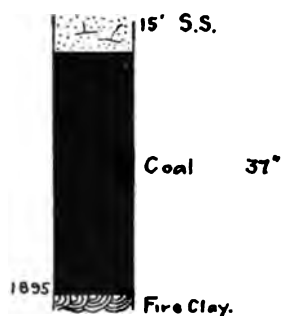
Fig. 255.
Section from Harlan Coal on Roberts Br of Poor Fork to Spur of Pine Mt.
Scale 200 ft = 1 inch.

number of instances—notably on the Kentucky river—they were found in close proximity to soft sandstone. Here they lie about 60 feet below the place of the Harlan coal.

By Poor fork, opposite the mouth of the Joe Day branch, is a small quarry from which flag-stones have been taken, varying from 1 to 6 inches in thickness. A number of them were used for grave stones in the neighboring burying-ground. They come from about 100 feet below the horizon of the Harlan coal.

Fig. 257.

JOE DAY BRANCH.



On the right, $34\frac{3}{4}$ miles up Poor fork; elevation of mouth, 1695.

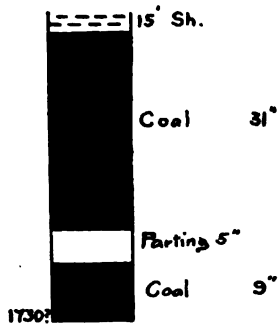
On the Right fork the Leonard coal shows 28 inches thick, elevation 1865; thin black slate and coal lie 20 feet over it, and the Keokee bed with about 38 inches of coal is exposed at elevation 1920. Five feet of massive sandstone forms a rock-house directly over it.

On the Left fork the same three beds show in or by the stream bed; the Leonard 25 inches of coal, partly splint, at elevation 1895; thin coal at 191, and 20 feet higher the Keokee as in figure 257. Sandstone fills the intervals, except the fire-clay floors.

On this branch and farther up Poor fork at intervals to Oven fork the topography somewhat characteristic of the Keokee bed is recognized. Most conspicuous in the southern flank of Little Black mountain, it consists of long, very narrow spurs nearly level on top either at or somewhat below the level of that coal. Their tops and sides are usually ill adapted to cultivation and are covered thickly with laurel and rhododendron.

The peculiar topography adjacent to the Harlan bed is prominent in the valley just above the Joe Day branch, and at intervals beyond.

Fig. 258.



Harlan Coal, J.K.F. Day.

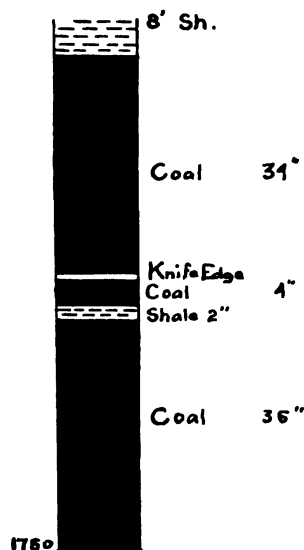
At 35 $\frac{3}{4}$ miles up Poor fork, about 20 feet above it, Mr. Thruston found the coal of figure 258, with 3 inches more coal 10 feet under it.

At 36 $\frac{1}{4}$ miles up Poor fork, about 10 feet above it, on Mr. Brown's land, he found the same bed with 62 inches coal and 6 inches parting, with strong southeast dip. Both of these openings appear now to be lost.

At 36 $\frac{3}{4}$ miles up Poor fork, 30 feet above it, on the left, $\frac{1}{4}$ mile up a small right branch, is the coal of figure 259, as measured in a 20-yard entry. But 5 feet above the branch and with a southeast dip of some 10 degrees (lessening immediately south) hardly enough area for local use lies above drainage.

OVEN FORK.

Fig. 259.



Harlan Coal, H.K. Raleigh.

On the right, 38 miles up Poor fork; elevation of mouth, 1740.

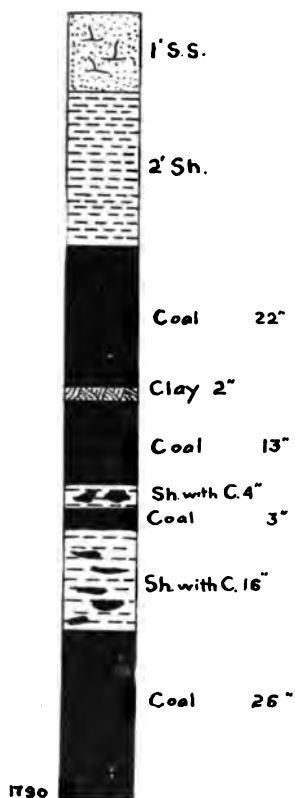
A thick coal was reported worked to some extent at stream level on the right at the big bend, $\frac{1}{2}$ mile up. Partly covered at the time of passing it was not visited. It is probably of the Harlan bed.

Frank's Creek. On the right, 1 mile up Oven fork; elevation of mouth, 1760.

For a general view of the coals of this vicinity see the longitudinal section, figure 5.

Figure 260 represents what is here considered the Harlan bed, as opened in one of several entries on the left, $\frac{1}{8}$ mile up the creek.

Fig. 260.



Harlan Coal, Levi Boggs.

This coal has heretofore been ascribed to the Imboden bed, and very naturally so, as it seems to correspond with that bed on the opposite side of Big Black mountain, at Stonega, Va., where the Harlan bed is widely split and of no importance, and no other bed in this vicinity seems to answer for the Imboden.

The coal, too, has a general resemblance to that of the Imboden on the south side of Big Black mountain, and shows, even, rash coal between two partings in one of these entries as the Imboden does in Virginia. But the rash is not constant and the coal is also similar to that found in the Harlan bed below on Poor fork.

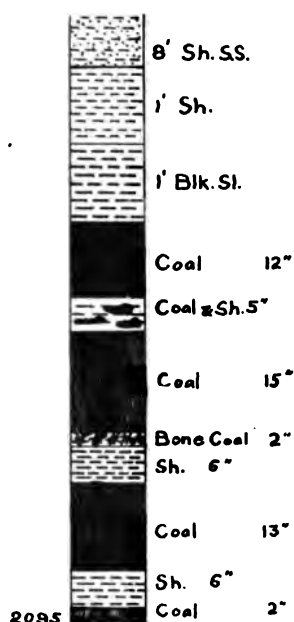
Having seen the succession of Harlan bed openings along Poor fork one can hardly fail to regard them as conclusive evidence of the correlation of this coal with them, but further proof is afforded by investigation (not in itself conclusive, either) of the succession of coals on Frank's creek.

The rapid up-stream dip of the coal continues to $\frac{1}{4}$ mile up the creek, where 2 feet of coal and shale go below drainage at elevation 1800, apparently about 50 feet above the Harlan bed.

One hundred feet above that coal is 33 inches of coal, with two partings, and black shale roof, elevation 1900.

In a cove on the left, $\frac{3}{4}$ mile up the creek, is 29 inches of coal, between sandstones, at elevation 2000, and 17 inches of coal under sandstone, at elevation 1960; and in the next drain above, 1 mile up, coal and black slate at eleva-

Fig. 263.



Low Splint Coal, Martin Collier.

Limestone coals are at heights above the Low Splint corresponding with those on Big Looney creek and the head of Clover fork. The interval to the High Splint bed is much less. A slight general thinning of strata northeast from the head of Big Looney creek, is probable, and a larger reduction above the Limestone coal.

The coal at elevation 3280 resembles the High Splint perfectly, and that at 3135, shown in figure 264,

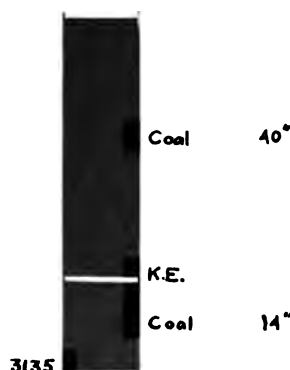
in place of the black slate roof found here.

In going up the road to the top of Big Black mountain the following notes were taken:

Ft.		Elevation,
Painter Lick gap.....		3330
2± Splint coal, 200 yds. west of gap	"	3280
High Splint (?) opening on left,	"	3135
Coal stain	"	3100
" " (under sandstone)	"	3045
" " (Limestone coal ?)	"	2890
" "	"	2600
1½ " " (Dean coal ?)....	"	2525
" "	"	2460
2 Black Slate. }		
3 Shale	"	2440
Coal . 8 in. }		
Tyler (low Splint) entry....	"	2155

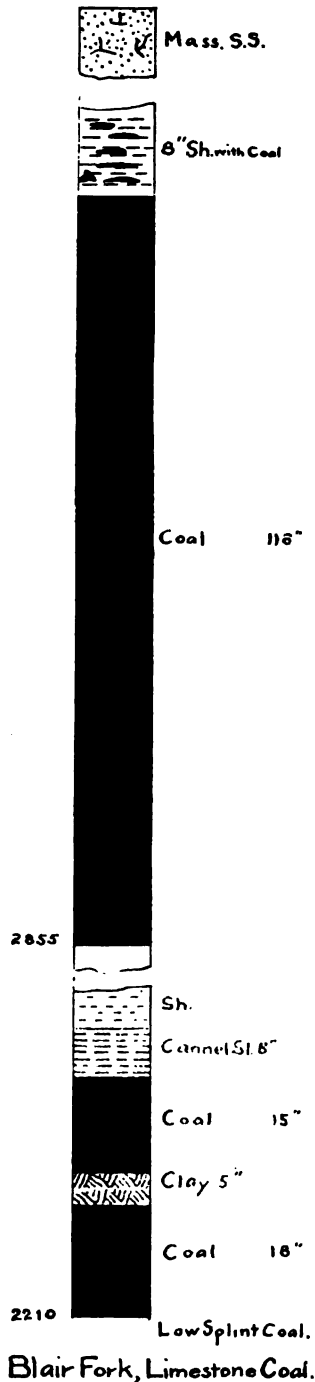
The section is probably lengthened 100 feet, more or less, by the up-stream rise of strata, which becomes noticeable above the mouth of Blair fork, though, without allowance for dip, the stains assumed for the Dean and

Fig. 264.



High Splint Coal? Head of Franks Cr.

Fig. 265.



may be of the Cornett or of some new bed, but, until it is proven otherwise, its thickness and quality relegate it to the High Splint. The upper seam of that at 3280 is in part splint coal. My sample of the whole bed, analyzed by Dr. A. M. Peter, yielded the following results:

HIGH SPLINT COAL (?) Lab. No. 2697.	
Moisture.....	2.23
Volatile combustible matter.....	35.37
Fixed carbon.....	56.21
Ash (buff).....	6.19
	100.00
Sulphur.....	0.66
Phosphorus.....	0.057
Coke.....	Dense, spongy.
Specific gravity.....	1.313
B. T. U.....	13,700

"Average sample of clean looking coal."

Blair Fork. On the left, $1\frac{3}{4}$ miles up Frank's creek; elevation of mouth, 1915.

On the right, $\frac{1}{4}$ mile up the fork, the Low Splint bed is opened in the Tyler entry, previously referred to, showing at its mouth:

10'	Clay sandstone.	
5'	Sandy shale	
	Cannel slate.....	5"
	Clay.....	6"
	Coal.....	17"
	Shale and coal.....	5"
	Coal.....	13"
		Elevation, 2155

This is 60 feet higher than the Collier entry, west across the

creek, but the correlation can hardly be questioned, Correct leveling might reduce the difference in elevations.

In the fork near the main road is a 1-foot coal under sandstone.

On the left, near stream level, $\frac{3}{4}$ mile up, the Low Splint bed shows again with the section of the bottom coal of figure 265. The cannel slate roof identifies it, and it shows a continued easterly rise of strata.

In the creek at $1\frac{1}{4}$ mile up is a bed reported to have two 3-foot seams of coal with a big parting between. If this is so it can hardly be other than of the Whitesburg bed, of some prominence on Kentucky river waters, but not likely to be of much importance here. Its greatest known thickness is in the vicinity of Whitesburg.

The upper coal of figure 265 is of the Limestone bed. Its imperfect opening showed a possible knife-edge parting 3 feet from the top, but with this exception it appears to be perfectly clean coal, probably the thickest in the State without material parting, though one near Hindman probably in the same bed comes close to it.

The bed is reported thinner east and west of this opening, but on the south side of the mountain it has been opened full 10 feet thick, with unimportant partings, and is reported to run for some miles over 9 feet thick.

It appears there to be about on the same level as at this opening, but levels were not carried over the mountain.

Smith Creek. On the left, 1 mile up Oven fork; elevation of mouth, 1760.

On the right, $\frac{1}{4}$ mile up, Henderson Boggs has an abandoned entry into the Harlan coal, at elevation 1780, 10 feet above the creek.

Stillhouse Branch. On the right, $\frac{3}{4}$ mile up Smith creek.

On the left, $\frac{1}{4}$ mile up, the lower bed, probably, of the Keokee group is opened with the following section:

4' Shale

Black slate.....	8"	
Coal.....	16"	
Shale.....	2" : 4"	
Coal.....	12"	El. 1930.

The black slate and parting tend to correlate this with the two openings with black shale and slate on the lower part of Frank's creek.

On the left, $\frac{1}{2}$ mile up, under the gap on the road to "Bunker Hill" the Low Splint bed has the section following:

8' Shale.

Black shale.....	3"	
Coal.....	8"	
Shale.....	1"	
Coal.....	10"	
Shale (with coal).....	11"	
Coal (mainly splint).....	20"	El. 2190.

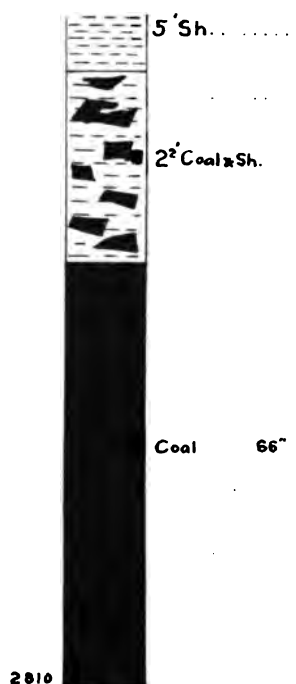
The elevation indicates that the rapid rise up Blair fork, Frank's creek, does not continue east of that fork.

The James Sturgill house, elevation 2455, Bunker Hill, $\frac{1}{4}$ mile east of the last mentioned opening, is on a big bench about on the level of the Whitesburg bed. The interval to the Dean coal above it probably some 40 feet greater here than in the vicinity of Whitesburg.

The Dean coal has been opened in a 7-yard entry by the Sturgill house, giving 27 inches coal and 3-inch flint fire-clay parting, elevation 2530.

The Limestone coal is opened at the head of a hollow, $\frac{1}{4}$ mile southeast of the house. Under cover it gave 66 inches of coal, as in figure 266. My sample of this coal analyzed by Dr. A. M. Peter, gave the following results:

Fig. 266.



Limestone Coal, Smith Cr.

LIMESTONE COAL.

Lab. No. 2698.

Moisture	2.93
Volatile combustible matter	33.54
Fixed carbon	54.12
Ash (yellowish)	9.41
	100.00
Sulphur	0.75
Phosphorus	0.051
Coke	Dense spongy
Specific gravity	1.354

"Average sample of clean looking coal. The ash is quite high but contains little iron."

On the right of Poor fork, 39 miles up, by the road from Frank's creek to Whitesburg, a coal 2 to 3 feet thick has been opened some 20 feet above stream, at elevation 1790.

If, as supposed, the place of the Imboden bed is near the top of the hill (with steep pitch to Oven fork) this should be one of the Dorchester, Va., beds.

BAD CREEK.

On the left, 40½ miles up Poor fork; elevation of mouth, 1900.

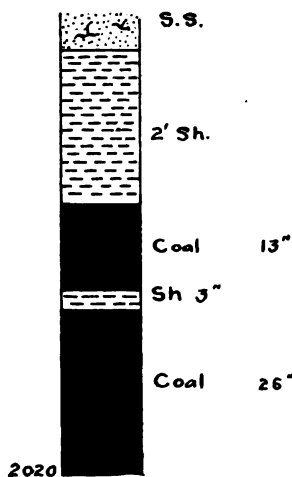
On the left, ⅛ mile up this small creek, W. M. Parsons has opened a bed containing 33 inches of coal with 5-inch parting, elevation 1950. It evidently lies far down in the Conglomerate measures.

MEADOW BRANCH.

On the right, 41 miles up Poor fork; elevation of mouth, 1920.

A half mile up to the Right fork, and a half mile up it is 14 inches of coal near stream level, elevation 2000.

Fig. 267.

**Meadow Br.**

opened for local use. This is the third opening on the left fork of Poor fork and none of them have what can be classed as workable coal, and it may be presumed that there is none such in Pine mountain above Harlan town.

Above it is the coal of figure 267, the lower seam of which is a semi-cannel coal.

These two coals appear to be of the Keokee group, but there is little in the vicinity to guide in correlation.

A half mile up the Left fork, which with Oven fork seems to carry the same geological conditions as Poor fork below Oven, in the high bank of the stream a thick bed of coal is exposed, elevation 2015, probably of the Harlan bed. It has a strong southeasterly dip beneath the bottom land on the right.

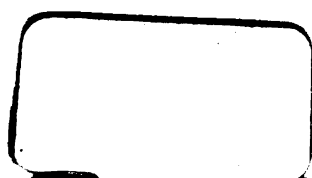
On the left, by the church $43\frac{1}{2}$ miles up Poor fork, 20 feet above it, coal 2 to $2\frac{1}{2}$ feet thick has been

Procter Gap. This gap, 44 miles up Poor fork, is at its head, with elevation 1980, distance and height, as are others generally in this report, being subject to correction. The easy ascent to it will make railroad building comparatively inexpensive, and as the descent of Pound river on the east is not much more difficult the two valleys seem likely to be provided with railroad transportation before many years.

The upper half mile of the Poor fork valley appears to lie directly on or in the main pebble rocks near the bottom of the Conglomerate formation, the strata in Pine mountain as shown by its slope, lying for a considerable distance up it, at a much less angle than obtains farther down Poor fork.

The rise above water level of the lower strata is consonant to some extent to an easterly rise in the last few miles of Big Black mountain to its end opposite Procter gap, beyond which the horizons of the high coals of this region are above the hill tops.







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